PB-229 734

PROCEEDINGS: CONFERENCE IN THE MATTER OF POLLUTION OF THE INTERSTATE WATERS OF THE COLORADO RIVER AND ITS TRIBUTARIES, HELD AT SAN DIEGO, CALIFORNIA ON MAY 27, 1963

Public Health Service
Washington, D.C.

27 May 1963

DISTRIBUTED BY:

NTIS

National Technical Information Service
U. S. DEPARTMENT OF COMMERCE
5285 Port Royal Road, Springfield Va. 22151

PB 229 734

PROCEEDINGS

CONFERENCE
in the matter of
POLLUTION
of the Interstate Waters of the
COLORADO RIVER
and its Tributaries

San Diego, California
May 27, 1963

Reproduced by
NATIONAL TECHNICAL
INFORMATION SERVICE
U S Department of Commerce
Springfield VA 22151

U.S. DEPARTMENT OF
HEALTH, EDUCATION, AND WELFARE
Public Health Service

94

CONFERENCE
in the matter of
POLLUTION
of the Interstate Waters of the
COLORADO RIVER
and its Tributaries

Convened on the Call of the
Secretary of Health, Education, and Welfare
Under Section 8 of the
Federal Water Pollution Control Act
(33 U.S.C. 466g et seq.)
San Diego, California
Monday, May 27, 1963

Reproduced by
NATIONAL TECHNICAL
INFORMATION SERVICE
U S Department of Commerce
Springfield VA 22151

U.S. DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE
Public Health Service
Washington, D.C. 20201

TABLE OF CONTENTS

	page
Opening Statement by Chairman Stein	1
General Discussion	70
Summary by Chairman Stein	84
Statement by Mr. Klashman	6
Statement by Mr. Sponagle	7
Statement by Mr. Fitzpatrick	8
Statement by Dr. Tsivoglou	28
Statement by Mr. Sponagle	39
Statement by Mr. Stewart	48
Statement by Mr. Davoren	50
Statement by Mr. Langley	51
Statement by Mr. Nussbaumer	53
Statement by Mr. Schoen	55
Statement by Mr. Williamson	59
Statement by Mr. Thatcher	61
Statement by Mr. Holder	63
Statement by Mr. Crawford	64
Statement by Mr. Redman	65
Statement by Mr. Shaw	66
Statement by Mr. Bonderson	67
Statement by Mr. Cole	69
Statement by Mr. Caldwell	73
Statement by Mr. Gahr	76
Statement by Mr. Beverly	79
Statement by Mr. Marx	81
Statement by Mr. Tame	83

Conference in the Matter of Pollution of The Interstate Waters of the Colorado River and its Tributaries, convened at 9:40 a.m., on Monday, May 27, 1963, in the La Sala Room, La Jolla Beach and Tennis Club, San Diego, California.

PRESIDING:

Mr. Murray Stein, Chief, Enforcement Branch, Water Supply and Pollution Control, Public Health Service, Department of Health, Education, and Welfare, Washington 25, D. C.

PRESENT:

UNITED STATES DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE:

Kenneth E. Biglane, Assistant Chief, Eastern Operations, Water Projects Section, Division of Water Supply and Pollution Control, Public Health Service, Washington, D. C.

L. C. Carter, Jr., Deputy Assistant Secretary, Washington, D. C.

John G. Connor, Chemist, Colorado River Basin Project Laboratory, Salt Lake City, Utah

James B. Coulter, Chief, Water Projects Section, Division of Water Supply and Pollution Control, PHS, Washington, D. C.

John G. Detmer, Regional Attorney, Region VIII, Denver, Colorado

Paul W. Eastman, Regional Program Director, WS&PC, PHS, Region IX, San Francisco, California

Joseph W. Fitzpatrick, Deputy Project Director, Colorado River Basin Project, PHS, Denver, Colorado

William C. Galegar, Director, Enforcement Activities, WS&PC, PHS, Region VII, Dallas, Texas

Croswell Henderson, Biologist, Colorado River Basin Project Laboratory, Salt Lake City, Utah

Dr. W. M. Ingram, Chief, Biological, Chemical & Oceanographic Activities, TSB, WS&PC, PHS, Cincinnati, Ohio

Lester M. Klashman, Regional Program Director, WS&PC, PHS, Region VIII, Denver, Colorado

Peter Kuh, Chief, Interstate Enforcement Section, Enforcement Branch, Division of Water Supply and Pollution Control, PHS, Washington, D. C.

Morton A. Lebow, Deputy Chief, Information Branch, DWS&PC, PHS, Wash., D.C.

Charles H. Petersen, Administrative Officer, Colorado River Basin Project, PHS, Denver, Colorado

Mrs. Rheta Piere, Conference Coordinator, WS&PC, PHS, Washington, D. C.

Albert L. Platz, Chief Sanitary Engineer, Division of Indian Health, PHS, Window Rock, Arizona

Frank H. Rainwater, Hydrologist, Water Projects Sec., TSB, Division of Water Supply and Pollution Control, PHS, Washington, D. C.

D. E. Rushing, Laboratory Director, Colorado River Basin Project Laboratory, Salt Lake City, Utah.

Jay S. Silhanek, SA Sanitary Engineer, PHS, WS&PC, Region IX, San Francisco, California

Charles E. Sponagle, Project Director, Colorado River Basin Project, PHS, Denver, Colorado

Irving M. Terzich, Chief, Enforcement Branch, WS&PC, PHS, Region IX, San Francisco, California

Dr. E. C. Tsivoglou, Chief, Physical & Eng. Sciences Unit, Tech. Advisory and Invest. Sec., WS&PC, PHS, Cincinnati, Ohio

REPRESENTATIVES OF OTHER FEDERAL AGENCIES:

Ernest E. Allen, Field Representative, Bureau of Outdoor Recreation, USDI, Denver, Colorado

William T. Davoren, Regional Coordinator, USDI, Salt Lake City, Utah

Donald F. Harmon, Source & Special Nuclear Material Branch, Division of Licensing Regulations, USAEC, Washington, D. C.

Floyd A. Henderson, Supt. Park Planner, Bureau of Outdoor Recreation, USDI, San Francisco, California

Burdge Irelan, Project Chemist, Geological Survey, USDI, Yuma, Arizona

Cecil B. Jacobson, River Control Engineer, Bureau of Reclamation, USDI, Salt Lake City, Utah

Maurice Langley, Assistant Chief, Division of Irrigation and Land Use, Bureau of Reclamation, USDI, Washington, D. C.

R. B. Maurer, Regional Director, Bureau of Mines, USDI, San Francisco, California

Joseph McCoy, Chief, Special Investigation Unit, Corps of Engineers, Los Angeles, California

C. C. McDonald, Project Hydrologist, Lower Colorado River Hydrologic Study, Geological Survey, USDI, Yuma, Arizona

Stewart F. Mulford, Field Engineer, Office of Saline Water, USDI, San Diego, California

REPRESENTATIVES OF OTHER FEDERAL AGENCIES: (Continued)

Donald A. Nussbaumer, Chief, Source & Special Nuclear Material Branch, Division of Licensing Regulations, USAEC, Washington, D. C.

Arthur M. Piper, Staff Scientist, Geological Survey, USDI, Menlo Park, California

Jack W. Rodner, Regional Supervisor of Irrigation, Bureau of Reclamation, Region 3, USDI, Boulder City, Nevada

Kirk M. Sandals, River Basin Representative, Pacific Southwest Soil Conservation Service, USDA, Berkeley, California

Arthur Schoen, Health Physicist, Division of Operational Safety, USAEC, Washington, D. C.

Clyde E. Stewart, Western Basin Programs, Economic Research Service, USDA, Logan, Utah

Kenneth E. Tame, Metallurgist, Bureau of Mines, USDI, Salt Lake City, Utah

REPRESENTATIVES OF STATE AND CITY GOVERNMENTS:

Paul L. Billhymer, General Counsel, Upper Colorado River Commission, Salt Lake City, Utah

Paul R. Bonderson, Executive Officer, State Water Quality Control Board, Sacramento, California

Norman G. Boyd, Mayor, City of Moab, Moab, Utah

Charles G. Caldwell, Director, Environmental Sanitation Services, New Mexico Department of Public Health, Santa Fe, New Mexico

Dallas E. Cole, Chief Engineer, Colorado River Board of California, Los Angeles, California

William N. Gahr, Chief Engineer and Director, Division of Engineering & Sanitation, Colorado State Department of Public Health, Denver, Colorado

W. S. Gookin, State Water Engineer, Arizona Interstate Stream Commission, Phoenix, Arizona

Ival V. Goslin, Executive Director, Upper Colorado River Commission, Salt Lake City, Utah

Ralph E. Graham, Director of Utilities, City of San Diego, San Diego, California

Davis C. Holder, Engineering Consultant, City of Moab, Grand Junction, Colorado

Lynne C. Larsen, Executive Officer, Regional Water Quality Control Board No. 4, State of California, Los Angeles, California

REPRESENTATIVES OF STATE AND CITY GOVERNMENTS: (Continued)

Gilbert W. Lee, Supervising Hydrologic Engineer, Colorado River Board of California, Los Angeles, California

Robert P. Lowe, Chief, Water-Sewage Section, Environmental Sanitation Services, New Mexico Department of Public Health, Santa Fe, New Mexico

George W. Marx, Director and Chief Engineer, Bureau of Environmental Health, Arizona State Department of Public Health, Phoenix, Arizona

W. Don Maughan, Principal Hydraulic Engineer, Colorado River Board of California, Los Angeles, California

George E. Shaw, Public Health Engineer, Bureau of Environmental Health, Nevada State Department of Health, Reno, Nevada

Arthur Swajian, Executive Officer, Colorado River Basin Regional Water Quality Control Board, Indio, California

Lynn M. Thatcher, Executive Secretary, Utah Water Pollution Control Board, Salt Lake City, Utah

D. B. Willets, Supervising Engineer, California Department of Water Resources, Los Angeles, California

Arthur E. Williamson, Director of Environmental Sanitation, Wyoming State Department of Public Health, Cheyenne, Wyoming

Dr. Bernard Udis, Associate Professor of Economics, University of New Mexico, Albuquerque, New Mexico

REPRESENTATIVES OF INDUSTRY:

Harry Barber, Boyle Engineering, San Diego, California

Robert G. Beverly, Administrator, Radiation Controls, Union Carbide Nuclear Company, Grand Junction, Colorado

Frank E. Brown, Jr., Resident Attorney, Climax Molybdenum Company, Climax, Colorado

June W. Crawford, Chief Engineer, Texas-Gulf Sulphur Co., Moab, Utah

H. M. Crooker, Con. Engineer, La Jolla, California

Ray Hebert, Urban Plans Editor, Los Angeles Times, Los Angeles, California

T. F. Izzo, Atlas Minerals Division of Atlas Corporation, Moab, Utah

R. E. Polenske, Vice President, Operations, Arizona Water Company, Phoenix, Arizona

Travis H. Redman, Assistant to the President, Texas-Zinc Minerals Corporation, Grand Junction, Colorado

P R O C E E D I N G S

OPENING STATEMENT

BY

MR. MURRAY STEIN

MR. STEIN: The Conference is open.

This conference in the matter of pollution of the interstate waters of the Colorado River and its tributaries between the States of Arizona, California, Colorado, Nevada, New Mexico, Utah, Wyoming, and the Department of Health, Education, and Welfare, is being held under the provisions of the Federal Water Pollution Control Act.

Under Section 8 of that Act, pollution of interstate waters which endangers the health or welfare of persons in a state other than that in which the discharges originate is subject to abatement.

We have a rather unique conference procedure under our Act; and, as a matter of fact, of late it has come in for some criticism on the ground that it is too burdensome and cumbersome and not active enough.

Surprisingly enough, however, I think it works; and this is one of the examples showing how it works.

This conference is between the official water pollution control agencies of the states concerned and the Federal Government. Of course the states and the Federal Government may invite other people to participate in the conference.

For the states, the conferees are Mr. George W. Marx of the Arizona State Department of Health;

Mr. Paul R. Bonderson, California State Water Pollution Control Board;

Mr. William N. Gahr, Colorado State Department of Health;

Mr. George Shaw of the Nevada State Department of Health;

Mr. Charles G. Caldwell of the New Mexico Department of Health;

Mr. Lynn M. Thatcher of the Utah Water Pollution Control Board; and

Mr. Arthur E. Williamson of the Wyoming Department of Public Health.

Mr. Lester Klashman, the Regional Program Director for the Federal Water Pollution Control Program, with Headquarters in Denver, is a conferee for the Department of Health, Education, and Welfare.

My name is Murray Stein, and I am from Headquarters in the Department in Washington.

At this point I would like to introduce our Deputy Assistant Secretary, whose office is charged with overseeing the administration of this program, also from

Washington, Mr. Lisle Carter. Mr. Carter.

The purpose of the conference is to bring together representatives of the states concerned and the Department of Health, Education, and Welfare to review the situation; to lay a basis for future action by all parties concerned; and to give the states and localities an opportunity to take any indicated remedial measures under state and local law, as will be seen by the representation at this table.

The Colorado River Basin Conference is the largest one ever attempted under the law. In order to man this project, we had to establish a special resident work group, an investigation team.

As a matter of fact, there are two work groups: One headquartered in Denver, and one in Salt Lake City. At the present time we have budgeted more than $500,000 a year to this project to carry it to its conclusion.

I think in the investigative water field, and for us in particular, this is a very large undertaking indeed.

We regard the conferees here representing the states as being comparable to the board of directors of the project. We are happy to say that, so far, we have been able to reach unanimity of agreement on most of the determinations, and we hope this will continue.

By the way, the first session of the conference was held in Phoenix, Arizona, on January 13, 1960; the second session at Las Vegas, Nevada, on May 11, 1961; the third session at Salt Lake City, Utah, May 9 and 10, 1962.

At the previous sessions, the conferees of course have determined that the Colorado River is an interstate river within the meaning of the Federal Act. At the first session of the conference the Department of Health, Education, and Welfare agreed to undertake, in cooperation with the states, an investigation and study to define the type of pollution problems that might exist in the interstate waters of the Colorado and its tributaries; and to include, among other things, a determination of the specific pollutants and their concentration and methods of securing the best water quality for a multiplicity of uses.

The Public Health Service agreed to present a detailed plan of study and investigation to the states and Federal agencies for review and comment. At the second session of the conference this was done.

Conferees representing all the states and the Federal Government agreed on the details of this study and investigation, and the study and investigation have been designated as the Colorado River Basin Project and will require about six years for completion.

At the present time our staff has been organized, and you will hear from representatives of that staff as to the work they have done during the last year and their plans for the next year.

In order to service the project, it was soon determined that there was need for a laboratory having very specialized skills. This was necessary because of the complex nature of the problems involving chemicals and radioactive material.

A laboratory, as most of you may know, has been established in Salt Lake City at 1750 South Redwood Road. The laboratory is also staffed and in operation.

We have always found that in pollution situations the important thing is to get an accurate picture of what is happening. Once we can get everyone to agree on a particular set of facts, I think the solutions almost present themselves. In an undertaking as vast as the Colorado River, this has been no small job.

I also think that, in dealing with the people on the state staffs and on our staff, we are dealing with reasonable people having relatively similar professional training. Once the facts are set forth, so far we have found no disagreement on getting a unanimity of opinion of what the facts are; and I imagine that this will continue.

The initial studies of the project during the first years were directed toward the radiological aspects of Colorado River water pollution. It was unanimously agreed by all the conferees that this problem should be given priority.

I think, on the basis of not just looking at this project but looking at the national water pollution control effort as a whole, those in the Basin and those in the uranium industry should be proud of the progress made in dealing with the radiological problem in this Basin.

I think it has to take second place to none in a problem which has been solved. This includes municipal and industrial waste problems throughout the country.

The results -- and, as many of you know, I don't use the superlative very often-- have been very little short of spectacular.

Almost nowhere in the Basin is there anywhere that there is any present danger from uranium mill activities to health or welfare.

The objectives and standards which have been established by the Atomic Energy Commission and other official agencies have been more than met. The radiation level in the river is far below the level recommended by the Public Health Service for drinking water and its drinking water standards, and this is quite an accomplishment.

However, since we do have the radiation problem fairly well solved, this doesn't mean we can forget about that. I think the solution points to the fact that we do have possibly further improvements to look forward to, safety factors, and the question of surveillance and vigilance to see that this record is maintained.

I think the conferees have agreed that there might be a change in emphasis in the major scope of the project.

In accordance with the request of the conferees that we consult with them at meetings, prior to and in addition to the formal conferences, we did have such a preliminary meeting in Santa Fe, New Mexico, on February 13, 1963.

There was agreement on the part of those present at the Santa Fe meeting that we should give consideration to considering or giving the problems of solids and salinity in the Colorado River primary attention during the next year.

We have some preliminary studies which have looked into the causes and extent of water quality deterioration in the Colorado River in the Yuma, Arizona, area and several other places. I am sure that you will hear about that at the conference.

Also at the preliminary meeting the states indicated that invitations were extended to all industries in the Basin which are interested in water quality to participate in future sessions of the conference. I am happy to see that many representatives of industry are here.

We would like to hear the views of these industries and would like to have all available data and views from these industries on what they think should be done about water quality in the Basin and what they think we should be doing in the project.

Last year the conferees agreed that the study group would conduct activities to:

(1) Develop comprehensive programs for water quality control, with emphasis on the upper main-stem of the Colorado River and Green River sub-basins;

(2) Collect and correlate required data and proceed with economic studies;

(3) Evaluate results of crop surveys with reference to radiological content;

(4) Conduct limited investigations into radium uptakes by stream biota, including fish;

(5) Conduct exploratory investigations of pollution from recreational boating;

(6) Investigate quality of water in Lake Mead and its suitability for domestic water supplies; and

(7) Conduct limited sampling of uranium mill effluents and environment media to ascertain levels of lead-210, in view of its possible water-contaminating qualities and its maximum permissible concentration.

In addition, the following activities were planned for the project:

(1) A further study and attempt to arrive at an acceptable solution for the problems of salinity caused by discharges from the Wellton-Mohawk Irrigation and Drainage District;

(2) Complete development of standards for construction of holding lagoons and dikes at uranium mills in cooperation with the Atomic Energy Commission and the state water pollution control agencies;

(3) Complete development for alerting systems for accidental spills from uranium mills in cooperation with the Atomic Energy Commission and the state water pollution control agencies;

(4) Investigate the Monticello, Utah, area for hazards from radioactive contamination;

(5) Investigate further the radiological and the toxic chemical conditions of the waters of Uravan, Colorado;

(6) Complete the Radium Monitoring Network and continue radium monitoring; and

(7) Continue on a limited basis monitoring of radiological current sediments.

I don't want all these references to radiation to be construed that radiation remains a big problem. These are real refinements that can be accomplished almost only when you have the radiation problem fairly well licked.

To show the detail and sophistication that we are getting into there, I think this is an indication of a problem which has been solved; and most of these -- as a matter of fact, all of them -- are extra safety devices and precautionary measures because of the nature of the material with which we are dealing.

Now a word about the procedure governing the conference. Mr. Howard Hudson, who is one of the top professional stenographic reporters in the country, is making the record of the conference.

We will make a summary of the conference available to the states for distribution; and also a verbatim transcript of the conference will be made available. Both can be obtained through your state water pollution control agencies.

We will call upon interested Federal departments and the various state agencies for statements. The conferees will be permitted to ask questions and make comments. At the conclusion of these, we will have a general discussion and then attempt a summary.

For the benefit of the record, we would like to have any person making a statement, other than the conferees, come up to the lectern and identify himself, both as to name and organization, before he speaks.

With that, we will call on Mr. Klashman for the Department of Health, Education, and Welfare.

However, before we do that, we would like to introduce Mayor Norman G. Boyd of Moab, Utah. Mayor Boyd.

Thank you for coming, sir.

STATEMENT OF
LESTER M. KLASHMAN
REGIONAL PROGRAM DIRECTOR
WATER SUPPLY AND POLLUTION CONTROL
PUBLIC HEALTH SERVICE
REGION VIII
UNITED STATES DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE
DENVER, COLORADO

MR. KLASHMAN: Thank you, Mr. Stein. I shall limit my remarks to merely introducing some of the people here representing our own Department, and also the other Federal agencies.

Mr. John Detmer, our Regional Attorney.

Mr. Paul Eastman, who is the Regional Program Director for Water Supply and Pollution Control in Region IX.

Mr. William Galegar, representing our Region VII office.

The Colorado River Basin, as you know, includes portions of three of our regions.

Dr. W. M. Ingram from our Sanitary Engineering Center in Cincinnati.

Mr. James Coulter from our Technical Services Branch in Washington.

Representing the Federal agencies, we have here Mr. Joseph McCoy from the Corps of Engineers, the Los Angeles District Office.

Mr. Donald Nussbaumer and Mr. Donald F. Harmon from the Atomic Energy Commission.

Mr. Clyde Stewart and Mr. Kirk Sandals of the Department of Agriculture.

From the Department of the Interior, Mr. Davoren, who is Regional Coordinator of the Department of the Interior representing the Secretary's Office.

Mr. Maurice Langley with the Bureau of Reclamation from their Washington office.

Mr. Kenneth Tame from their Salt Lake City office.

Mr. Jack Rodner of Region III of the Bureau of Reclamation.

Mr. Sponagle is our Project Director for the Colorado River Project Study. Two of his staff members are here, who will not be presenting papers -- Dr. Rushing, who is chief of our laboratory, and also Mr. Henderson and also another staff member, Mr. Connor.

Mr. Sponagle will now take over and make our presentation and introduce the other speakers.

INTRODUCTION BY
CHARLES E. SPONAGLE
PROJECT DIRECTOR
COLORADO RIVER BASIN PROJECT
PUBLIC HEALTH SERVICE
UNITED STATES DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE
DENVER, COLORADO

MR. SPONAGLE: Our report to the conference this morning will be given in three parts, as indicated on the agendas which you have before you.

The first part of our report will be presented by Mr. Joseph Fitzpatrick, Deputy Project Director, who will discuss the activities that we are undertaking, other than the radiological investigations.

Dr. Ernest Tsivoglou, Chief of the Radioactive Pollution Activities of the Technical Services Branch of the Division of Water Supply and Pollution Control, will follow Mr. Fitzpatrick for a discussion of the aspects of the project associated with radiological investigations.

I will conclude our presentation with a discussion of the studies of salinity in the Basin proposed as a major work area for the project in accordance with the conclusions reached at the technical meeting in Santa Fe.

Without further ado, then, I will call upon Mr. Fitzpatrick to present his report on the project activities, other than the radiological investigations. Mr. Fitzpatrick.

STATEMENT OF
JOSEPH W. FITZPATRICK, DEPUTY PROJECT DIRECTOR
COLORADO RIVER BASIN PROJECT
PUBLIC HEALTH SERVICE
UNITED STATES DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE
DENVER, COLORADO

MR. FITZPATRICK: Thank you, Mr. Sponagle.

Mr. Chairman, Conferees, Ladies and Gentlemen: I would like to state that a copy of my paper has been furnished the conference reporter for the record.

During the presentation of my paper we are going to show some slides on the screen in the rear of the room. Realizing that it will be rather difficult for some of the people in our audience here to see the slides, we have placed about half a dozen copies of the prints of the graphs on the various tables.

I would appreciate it if you would share these. They are limited. The conferees have all been furnished with copies of these.

The "Summary of Conference, (Third Session), Pollution of the Interstate Waters of the Colorado and its Tributaries (Colorado, Utah, Arizona, Nevada, California, New Mexico, Wyoming), May 9-10, 1962," contained a list of activities the Colorado River Basin Project planned to carry out during fiscal year 1963. A technical meeting was held in Santa Fe, New Mexico, February 13-14, 1963, at which the Conferees had an opportunity to review progress.

There were two original objectives prescribed for undertaking by the Project. These two objectives were stated in the paper, "Colorado River Basin Project on Water Quality Control," dated June 30, 1960, which summarized the proceeding of the first Conference session. I will quote those objectives:

1. "A determination of the specific pollutants and their concentrations which now exist, or which may reasonably be expected to exist in the immediate future resulting from various water uses within the Basin, and the establishment of priorities for developing data on, and securing needed remedial action at, the most critical and pressing problem areas.

2. "A determination of methods for securing the best possible water quality for multiple water use and the development of a comprehensive plan and program of water quality control for multiple water use within the Basin which can serve as a guide for the Conference in progress and other enforcement actions which may be instituted subsequently, and to State and Federal agencies having an interest in the prevention and control of water quality . . ."

During the technical meeting in Santa Fe it was emphasized that the two most significant pollutants under consideration during the past year have been radioactive elements and total dissolved solids. Municipal and industrial wastes, other than radioactive, are of lesser importance. These will, of course, be considered in their proper perspective as the Project activities move forward. However, radioactive elements and total dissolved solids have been and will be given priority. Project activities have been reduced on radioactive pollutants. This will be discussed further by Dr. Tsivoglou.

In our discussions, reference will be made to the fulfillment of the Project's objectives previously mentioned. Dr. Tsivoglou's presentation will include comments

on certain of the items contained in the Summary of Conference, Third Session. These items are items 3 and 4 on page 8; item 7 on the top of page 9; and items 2 through 7 on the remainder of page 9. The remaining items are 1 and 2 on page 8, and item 1 on page 9. No substantial work was done on items 5 and 6 on page 8. I shall proceed to discuss the Conference Summary items that do not relate to radioactive pollution.

The first Conference item concerns an activity in the Lower Basin related to the problem of pollution by total dissolved solids and the interference with legitimate water use. This activity is related to Conference item 1 on page 9 of the Summary. The report concerning this activity, entitled "Colorado River Salinity Problem Study, Yuma, Arizona, area, June 1961 - June 1962," is almost completed and should be in the hands of the Conferees in the immediate future.

MR. STEIN: Mr. Fitzpatrick, what do you mean by the immediate future?

MR. FITZPATRICK: Within the next two months, Mr. Chairman.

This report describes field activities and presents the following conclusions:

1. Review and interpretation of the data resulting from the Project's salinity network sampling clearly show that the extreme quality degradation of the Colorado River in the Yuma area is a result of saline return drainage originating in the Wellton-Mohawk Inrrigation and Drainage District.

2. Since the introduction of return drainage from the Wellton-Mohawk Irrigation and Drainage District through the Gila River channel into the Colorado River, the City of Yuma has been unable to obtain a usable public water supply from the river at its historic diversion site. The City of Yuma has abandoned this water supply diversion which has been maintained in essentially the same location since the 1890's.

I shall present some data from the Yuma report. These will be slides shown on the screen in the back of the room and also, as I mentioned, on the tables which we have in limited quantities. Incidentally, some of these slides are in color, and I request that they be produced in black and white for the record.

MR. STEIN: Thank you, Mr. Fitzpatrick. All reproduction will be made in black and white. We do not reproduce in color.

MR. FITZPATRICK: Figure 1 illustrates the dramatic increase in total dissolved solids concentrations in the Colorado River at Yuma beginning in December 1960. Concentration data prior to December 1961, included in Figure 1, were obtained from unpublished provisional water quality information obtained from the U. S. Geological Survey. The Project's station data is shown for the later indicated period. It is shown that previous to December 1960, concentrations did not exceed 1,000 ppm. Concentrations doubled in December 1960, and reached the level of 2,980 ppm in October 1961.

Figure 1A shows the results obtained by the Project on analysis for total dissolved solids concentrations during a seven-months' sampling period, December 1961 through June 1962. The data obtained from the sampling station located on the Colorado River above the confluence with the Gila River essentially reflects the water quality situation occurring at the Yuma water intake prior to the advent of the return drainage from the Wellton-Mohawk District. The mean monthly level of total dissolved solids concentrations at this upstream main stem station ranged from 860 ppm to 1,080 ppm and averaged 960 pp. The data obtained for the river at Yuma showed that the mean monthly total dissolved solids concentrations ranged from 2,230 ppm to 3,010 ppm with an average concentration of 2,550 ppm. Thus, the average concentration of total dissolved solids for the period of record at Yuma approaches three times that of the Colorado River above the confluence of the Gila River.

Information on chloride levels at Yuma is available from March 1958 to the present from the National Water Quality Network Station at that location. This station is one of over 125 developed by the Division of Water Supply and Pollution Control cooperatively with state, local, and industry people. As indicated in Figure 2, mean monthly chloride concentrations at Yuma increased from approximately 170 ppm in October 1960, to about 540 ppm in January 1961, corresponding to the initiation of return drainage from the Wellton-Mohawk District. The chloride concentrations increased further as shown on the graph.

Figure 2A shows that during the period of sampling carried out by the Project, December 1961 through June 1962, the mean monthly chloride concentration at the station above the Gila River ranged from 130 ppm to 200 ppm, with an average of 150 ppm. The station at Yuma showed mean monthly concentrations from 790 ppm to 1,180 ppm, with an average of 940 ppm. Thus, the average concentration of chlorides for the period of record at Yuma is about six times that of the station above the return drainage from the Wellton-Mohawk District.

Figure 2B shows the mean monthly weight of total dissolved solids above the Gila River and at Yuma. The shaded portion indicates contributions from the Wellton-Mohawk District. These were measured at the Wellton-Mohawk drain above the Gila River siphon. The loadings ranged from 1,680 to 3,570 thousand pounds per day above the Gila channel, with an average of 2,480 thousand pounds per day; and 9,580 to 15,260 thousand pounds per day, with an average of 13,450 thousand pounds per day at Yuma. This weight of total dissolved solids represents an increase of about 540 percent. The weight of total dissolved solids measured from the Wellton-Mohawk District ranged from 6,280 to 10,690, and averaged 9,380 thousand pounds per day. The contribution through the Gila River channel, therefore, is about 70 percent of the total dissolved solids occurring in the river at Yuma.

Figure 3 shows the mean monthly weight of chlorides at the various stations during the period of Project sampling. The shaded portion again is the contribution from the Wellton-Mohawk District. The loadings ranged from 310 to 540 thousand pounds per day above the Gila River channel, with an average of 390 thousand pounds per day; and 3,360 to 5,590 thousand pounds per day at Yuma, with an average of 4,930 thousand pounds per day. This weight of chlorides represents an increase of almost 1,260 percent. The weight of chlorides measured from the Wellton-Mohawk District ranged from 2,610 to 4,530, and averaged 4,040 thousand pounds per day. Thus, the Wellton-Mohawk District return drainage contributes over 80 percent of the average chlorides content at Yuma.

With the exception of the Yuma study, most of the Project's activities have been located in the Upper Basin. These activities are related to the consideration of total dissolved solids as the primary pollutant. The discussion of these activities can be related to items 1 and 2 on page 8 of the Summary of Conference, Third Session. These items relate to the development of comprehensive programs for water quality control and related economic studies.

During Fiscal Year 1963, the economic base study has been carried forward through contracts with the Associated Rocky Mountain Universities, Inc., and the Economic Research Service, U. S. Department of Agriculture. Close working relationships have been maintained by the Project economists. We will receive a draft of the economic base study for the Green River Sub-Basin in June, and the final report in August. It is anticipated that an overall economic base study for the entire Basin will proceed to completion in an orderly manner under various contract arrangements. The base study will enable the forecasting of the Basin's economic development with various levels of water quality. This will enable an economic evaluation of feasible control methods.

Activities during the year concerning basic data on municipal and industrial water use and waste discharge have consisted of tabulation and summarization of these data for the Green and the three lower Sub-Basins. Basic data for municipalities is, in essence, complete; however, certain information is lacking concerning industries, which will be obtained during field activities. This activity is focused on locating points of water use and waste discharge, the determining of quantities involved, the defining of wastes or waste characteristics, and the analysis of effects of discharges on water uses.

The second stage computer analysis of USGS chemical water quality data was completed. Completion of this work enables better definition of the total dissolved solids buildup in the Colorado River and will be of use in future activities of the Project.

In connection with this activity, and in order to assist in relating changes in total dissolved solids to causes, a water quality sampling network on the Upper Main Stem was established to supplement the areal coverage of USGS water quality data. Samples have been taken at 22 locations, once a month, since July 1962. In addition, field conductivities were obtained at twenty additional locations at the same frequency.

Figure 4 illustrates that the total dissolved solids increases from less than 100 ppm in the headwaters, to more than 800 ppm in the lower reaches of the Colorado River. The figure was obtained from the Colorado River Board of California publication, "Salinity Problems in the Lower Colorado River Area," September 1962, and shows the average concentrations for the five-year record period, 1953-1957. Similar patterns have developed based on other periods of record. The figure shows a rapid increase from less than 100 ppm at Hot Sulphur Springs to more than 600 ppm at Hite. This increase, in little over 400 miles of stream, is attributed to both natural and man-made salinity sources. The next rapid rise between Lees Ferry and Grand Canyon is from natural sources, since there is no large irrigation or other water use in that area. The remainder of the chart shows a gradual increase to a point below Imperial Dam. This increase also is attributed to natural and man-made sources. The Project must define the salinity sources causing the degradation in water quality. As previously mentioned in the discussion concerning Yuma, total dissolved solids concentrations are now greater below the Gila River channel than shown on the figure.

Field studies in the Grand Valley area during February, March, and August 1962, and in the Gunnison River Basin, August and September 1962, will be covered in one report. This report is in the final stages of completion. I wish to present some background on this activity and data obtained during field activities. This data shows that man-made salinity sources cause degradation of water quality.

During radiological studies of the Colorado River in the vicinities of Grand Junction, Colorado, and Moab, Utah, during August 1960, it was noted that total dissolved solids and sulfate concentrations were high. The total dissolved solids and sulfate additions from the Gunnison River and from the irrigated area of the Grand Valley seemed to be the major contributors. More comprehensive surveys of the Grand Valley area and the Gunnison River drainage area were seen to be needed to identify the sources.

The survey of the Grand Valley area was carried out in two phases. The first phase was from February 19 to March 3, 1962, during the nonirrigation season and included the Colorado River from Cameo, Colorado, above Grand Junction, to below Moab, Utah. The second phase, from August 6 through 18, 1962, during the irrigation season, covered from Cameo downstream to Westwater, Utah, near the Colorado-Utah state line.

As shown on Figure 4A, total dissolved solids concentrations increased from 550 ppm at Cameo to 760 ppm at Westwater, Utah, during the February phase of the survey. During August, the total dissolved solids increased from 470 to 960 ppm in the same reach of the river.

Figure 4B shows that total dissolved solids loadings during February increased from 6,600 thousand pounds per day at Cameo to 13,500 thousand pounds per day at Westwater, with the Gunnison River system contributing 4,100 thousand pounds per day of the increase. During the August phase of the survey, total dissolved solids loading was 8,100 thousand pounds per day at Cameo, and increased to 17,600 thousand pounds per day at Westwater. The Gunnison River added 5,200 thousand pounds per day and surface irrigation return drains contributed 6,300 thousand pounds per day.

Sulfate concentrations shown on Figure 4C, during the February survey phase, increased from 130 ppm to 330 ppm, while during August it was increased from 110 ppm to 430 ppm between Cameo and Westwater. Sulfate loadings, shown on Figure 4D, during February were 1,600 thousand pounds per day at Cameo and increased to 5,900 thousand pounds per day at Westwater, with the Gunnison River contributing 2,300 thousand pounds per day. During August there were 2,000 thousand pounds per day at Cameo, which increased to 7,900 thousand pounds per day at Westwater, Utah. The Gunnison River contributed 2,800 thousand pounds per day, while 3,200 thousand pounds per day were carried to the river in surface return drains. The data presented shows that irrigation usage is of major concern in saline degradation of water quality.

The survey of the Gunnison River was carried out August 27 through September 8, 1962. A large increase in total dissolved solids and sulfates was noted where the Gunnison River and its tributaries pass through irrigated agricultural areas. The Uncompahgre River, a tributary -- and I might note that I am sorry we do not have slides on these, but I would like to give a few examples of these increases as I go along -- increased from 300 ppm of total dissolved solids above irrigated areas, to 2,030 ppm at its mouth; and from 80 thousand pounds per day, to 1,960 thousand pounds per day over the same reach of the river. Sulfates increased from 200 ppm to 1140 ppm, and 50 thousand pounds per day to 1,100 thousand pounds per day in the Uncompahgre.

The north fork of the Gunnison River contained 90 ppm and 100 thousand pounds per day of total dissolved solids above irrigated areas, and increased to 1,640 ppm and 800 thousand pounds per day at the mouth, below irrigated areas. In the same reach of the river, the sulfate concentrations increased from 10 ppm to 920 ppm, and the loadings from 9 thousand pounds per day to 440 thousand pounds per day.

The Gunnison River main stem above irrigated areas contained 120 ppm and 750 thousand pounds per day of total dissolved solids, and 20 ppm and 150 thousand pounds per day of sulfates. Below the irrigated area and the entrance of the North Fork and Uncompahgre Rivers, the river contained 1,610 ppm and 5,600 thousand pounds per day of total dissolved solids and 920 ppm and 3,200 thousand pounds per day of sulfates.

The report concerning the Dolores-San Miguel Rivers' water quality study will be completed early next fiscal year. This study was carried out during March 1962, for the purpose of obtaining detailed information on the chemical, radiological, and biological water quality and to differentiate between natural and man-made sources of pollution. For the purpose of emphasizing the contributions to total dissolved solids from natural sources, I should like to present graphs which show a very significant increase in concentration and loading of total dissolved solids caused by the flow of the Dolores River through the Paradox Valley. The subsurface salt deposits are dissolved from the formation in this valley and enter the river. Figure 5 shows that the total dissolved solids are increased from a concentration of 660 ppm to 4,270 ppm, and the loading from 282 to 2,131 thousand pounds per day in this reach of the river.

Figure 6, concerning ~~this~~ same river reach shows that the chloride concentrations increased about 20 times, from 110 ppm to 2,220 ppm, and the sodium concentrations increased about 15 times, from 90 ppm to 1,340 ppm. Other constituents did not change substantially; thus, nearly all the total dissolved solids change was due to sodium chloride increases.

Biological studies carried out on the Dolores-San Miguel Rivers as a follow-up to studies of August 1960 indicated that the highly toxic effluent entering the San Miguel River from the Uravan mill caused very poor biological conditions past the Utah border on the Dolores River. It is our understanding that the Uravan mill has constructed a holding pond to abate the pollution problem caused by the toxic plant effluent. This pond was to be placed in operation in May of this year.

Similar situations concerning the toxic effects on the aquatic environment of Canyon Creek, Red Mountain Creek, and the Uncompahgre River downstream as far as the proposed Dallas Creek Reservoir site, have been called to the attention of the Colorado State Department of Health. These conditions are caused by mine and mill drainages. The problem of toxic conditions near the town of Telluride, Colorado, and its potential effect on a proposed Bureau of Reclamation reservoir has also been called to the attention of the State.

Limited planning and activity continued throughout the fiscal year on hydrologic studies. The studies are for the purpose of defining the present and future patterns of streamflow. Recruitment is underway to fill key positions to carry out additional activities in this area.

In conclusion, and prior to turning to Dr. Tsivoglou for completion of the report on Project activities, I would like to mention that a considerable amount of effort has been spent on the development of a program that will fulfill Project objectives and will concentrate on total dissolved solids as a significant pollutant. The activities that I have discussed are a foundation for the future program. This will be discussed by Mr. Sponagle during his presentation.

MR. STEIN: Thank you, Mr. Fitzpatrick, for a very excellent and comprehensive report. This is indeed as lucid a presentation of a very technical and difficult subject as I have heard.

I would like to ask the conferees if they have any comments or questions at this time?

I would like to ask you one question, then. Are you familiar with the old power dam on the Uncompahgre River?

MR. FITZPATRICK: No, sir, Mr. Chairman, I am not.

MR. STEIN: Let me call this problem to the attention of the conferees. Evidently during the 1920's there were a lot of little dams built, some with and some without licenses from the Federal Power Commission.

During the twenties there was quite a controversy as to whether the dam should go in, as there generally is with dams. The situation then was resolved in a compromise. Conservationists were opposed to some of the dams; and of course some of the others were in favor of them. Most of these dams received fifty-year licenses. These licenses are expiring now.

A lot of these dams have relatively low kilowatt capacity in light of modern conditions. The Federal Power Commission is looking at all these dams with a view as

to whether to renew the licenses or what conditions to place on the licenses when they are renewed.

One of the things they are looking at -- and perhaps one of the most important things -- is the utilization of these dams for water quality control.

I understand there is one of these dam sites, if I am not mistaken, on the Uncompahgre River. In any of our recommendations to the Federal Power Commission in this Basin, we would like to ask the states to join with us in developing a recommendation on that, so that this can be more meaningful to the Federal Power Commission and this will reflect the views of all of us interested in the quality of water in this Basin.

MR. THATCHER: Could the staff develop figures on the capacity and the amount of benefit that might be derived from the use of the reservoir for this purpose?

MR. STEIN: Yes, I think we would have to do that. This is a suggestion: We are going to have to do that as part of our function anyway because we are so requested by the Federal Power Commission.

Therefore I think it would be best if in this Basin this would be done in conjunction with this project here so we can get the views of all the states on our recommendations and on our studies, and we won't be put in the position, for example, of having to come up with a report, possibly very, very rapidly, without this.

I want to explain our position on this in the Federal Establishment. In this, we are just consultants to the Federal Power Commission. We would be happy to have your views in our recommendations to the Federal Power Commission.

How the Federal Power Commission handles this and who they consult with afterwards, I don't know. I don't know that the Federal Power Commission has had much experience in this problem before, and I guess it is a new field. But we will certainly have the states' views in our comments if it is at all possible, and this seems to me to be the vehicle for doing this in this area.

Thank you, Mr. Fitzpatrick.

MR. SPONAGLE: I would like to call at this time upon our next speaker, Dr. Ernest Tsivoglou, who will present a discussion of the activities in the radiological field.

(The charts referred to by Mr. Fitzpatrick, Figures 1, 1A, 2, 2A, 2B, 3, 4, 4A, 4B, 4C, 4D, 5 and 6 are as follows:)

FIGURE 1

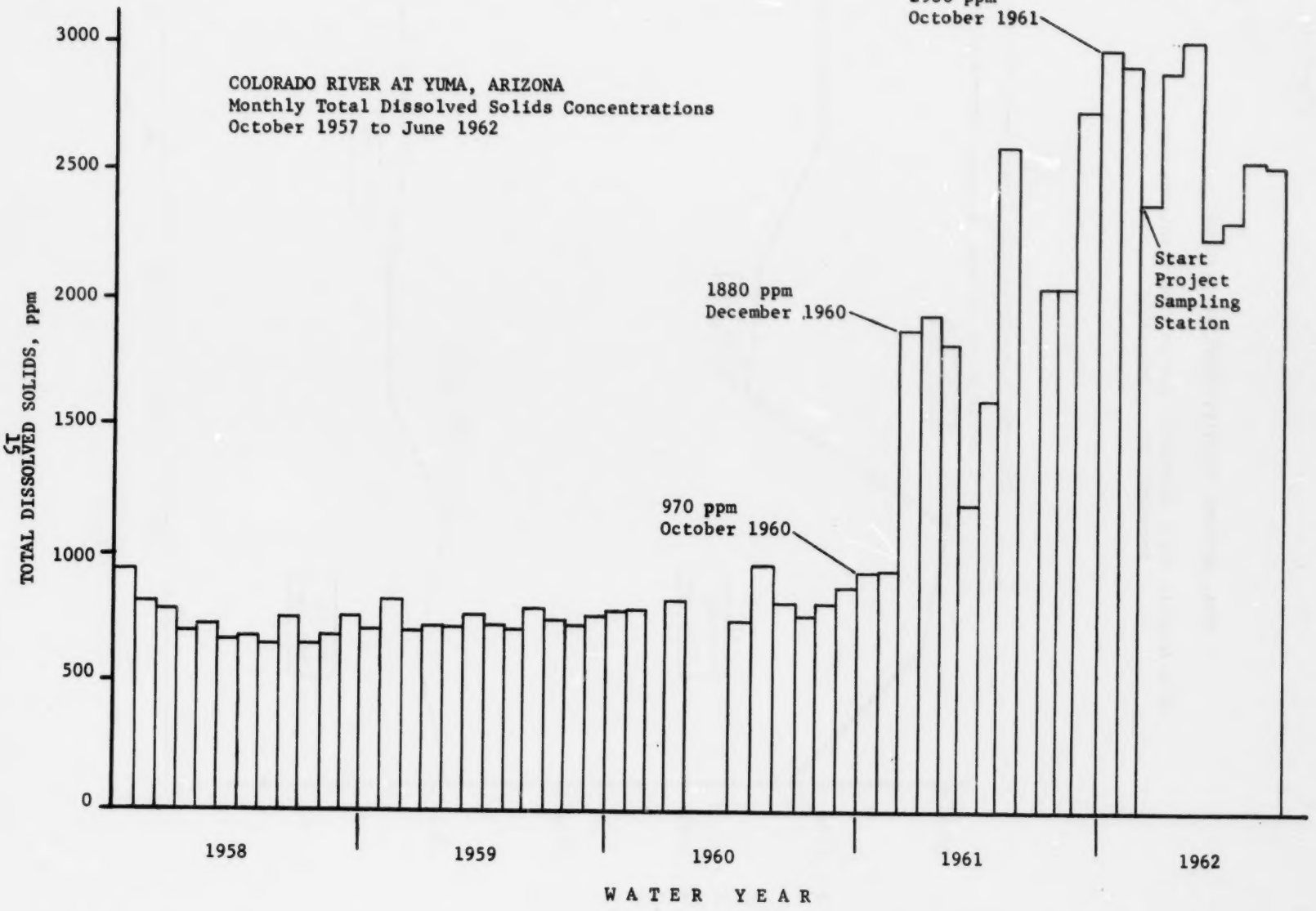

COLORADO RIVER AT YUMA, ARIZONA
Monthly Total Dissolved Solids Concentrations
October 1957 to June 1962
2980 ppm
October 1961
1880 ppm
December 1960
970 ppm
October 1960
Start
Project
Sampling
Station
TOTAL DISSOLVED SOLIDS, ppm
3000
2500
2000
1500
1000
500
0
1958
1959
1960
1961
1962
WATER YEAR

Figure 1A

YUMA, ARIZONA VICINITY SAMPLING NETWORK

Mean Monthly Total Dissolved Solids Concentration, ppm
December 1961 - June 1962

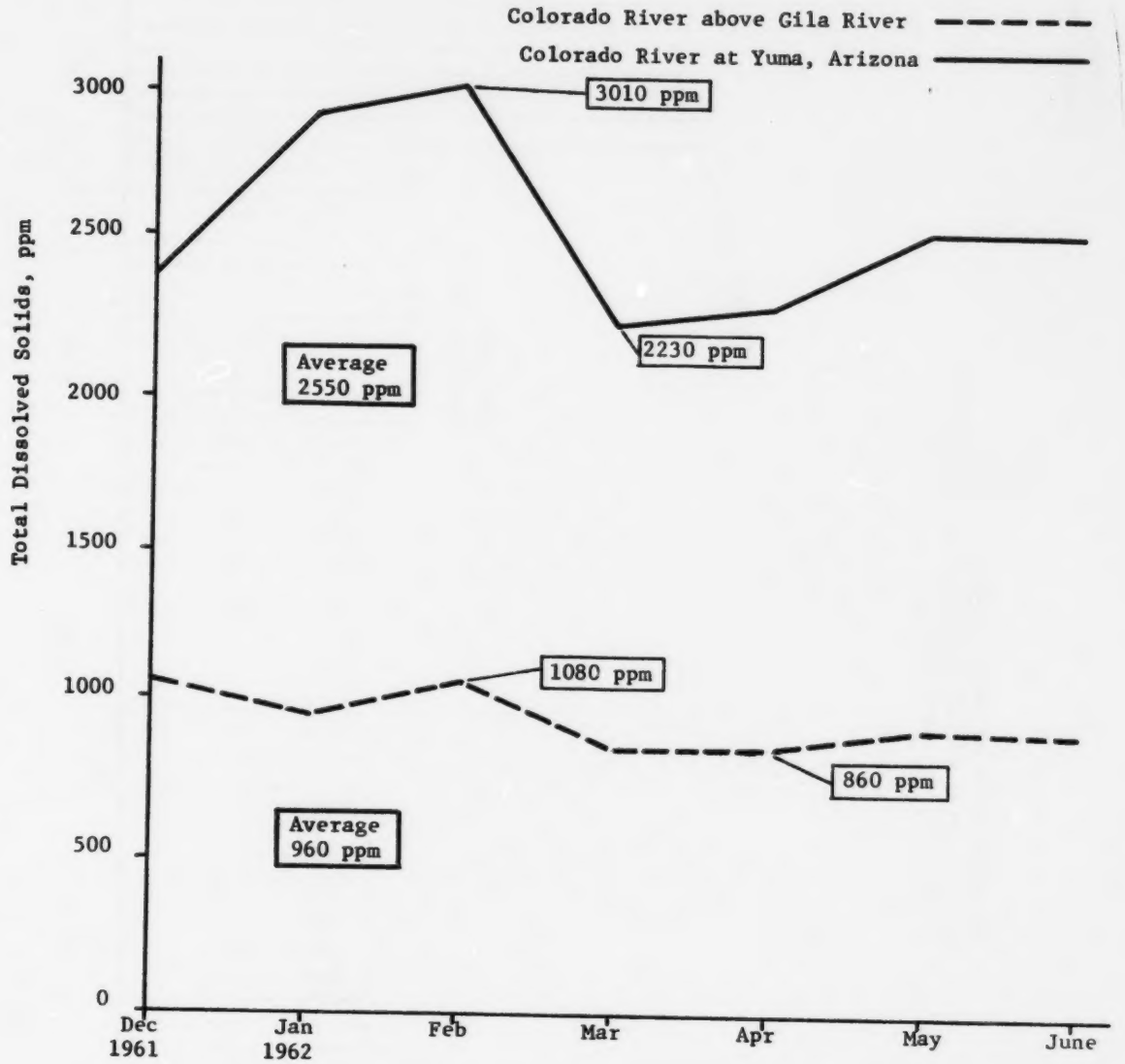


FIGURE 2

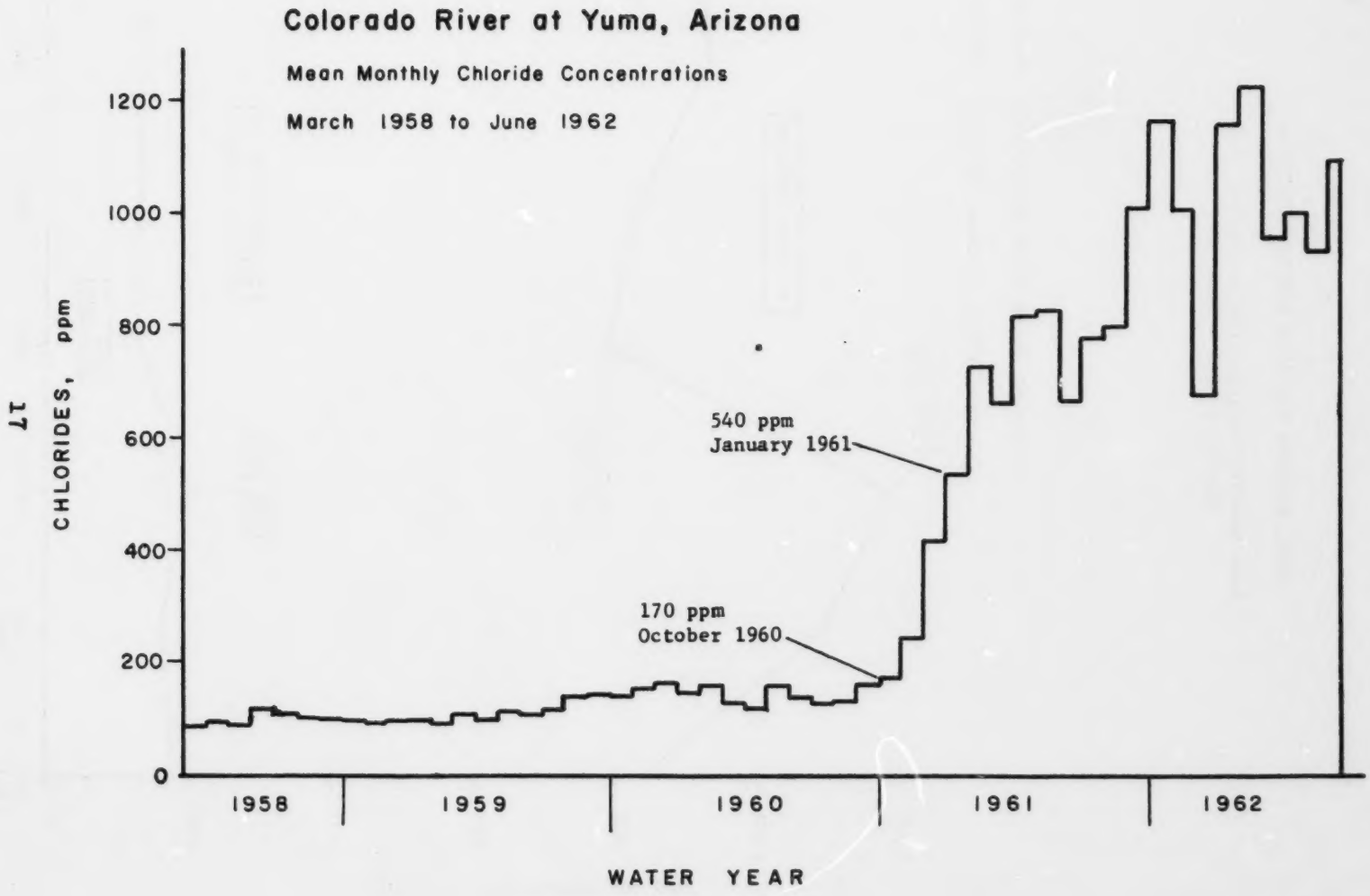

Colorado River at Yuma, Arizona
Mean Monthly Chloride Concentrations
March 1958 to June 1962
CHLORIDES, ppm
1200
1000
800
600
400
200
0
540 ppm
January 1961
170 ppm
October 1960
1958
1959
1960
1961
1962
WATER YEAR

Figure 2A

YUMA, ARIZONA VICINITY SAMPLING NETWORK

Mean Monthly Chloride Concentration, ppm
December 1961 - June 1962

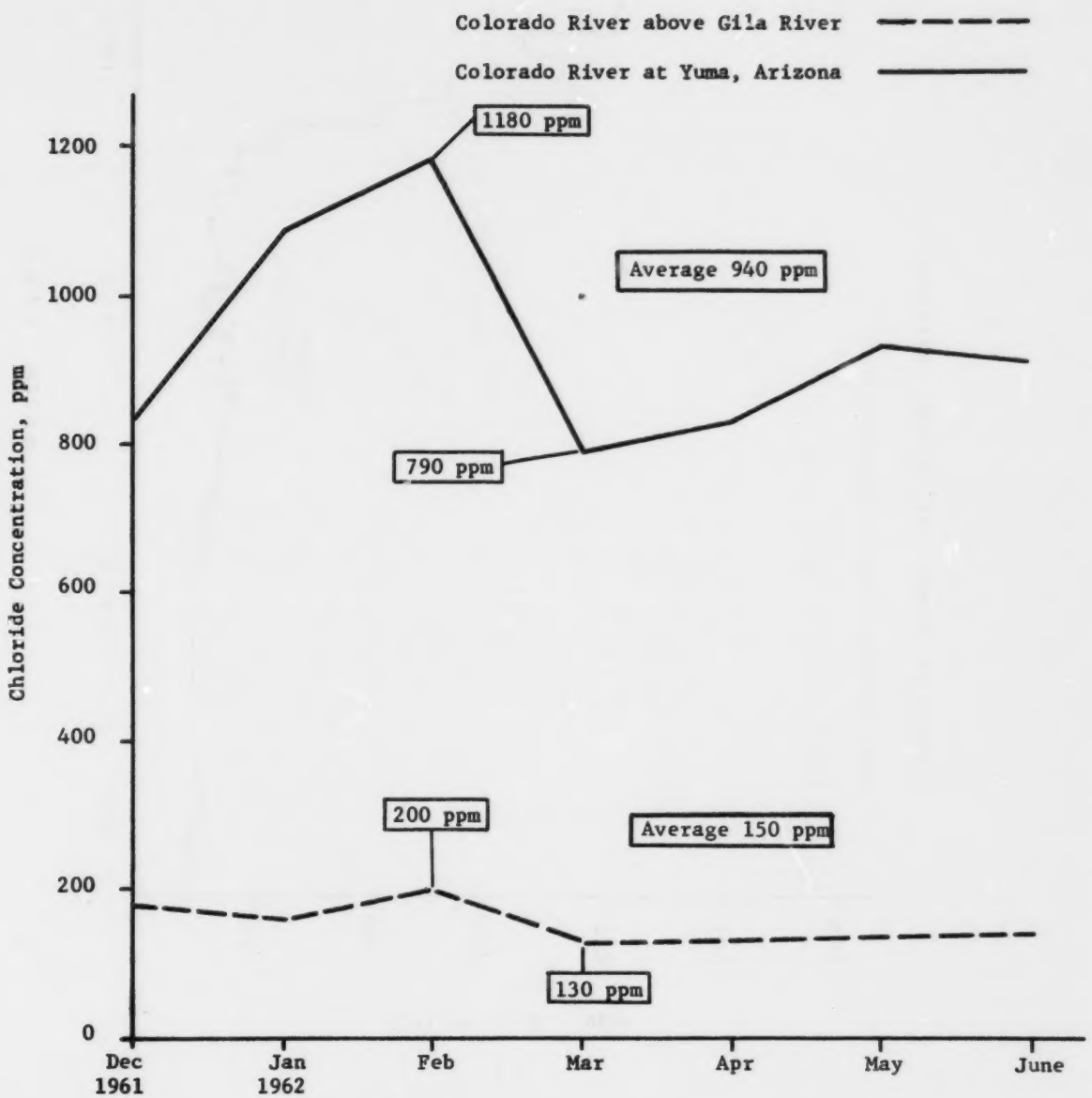


Figure 2B

YUMA, ARIZONA VICINITY SAMPLING NETWORK

Mean Monthly Total Dissolved Solids, Loading thousand lbs/day
December 1961 - June 1962

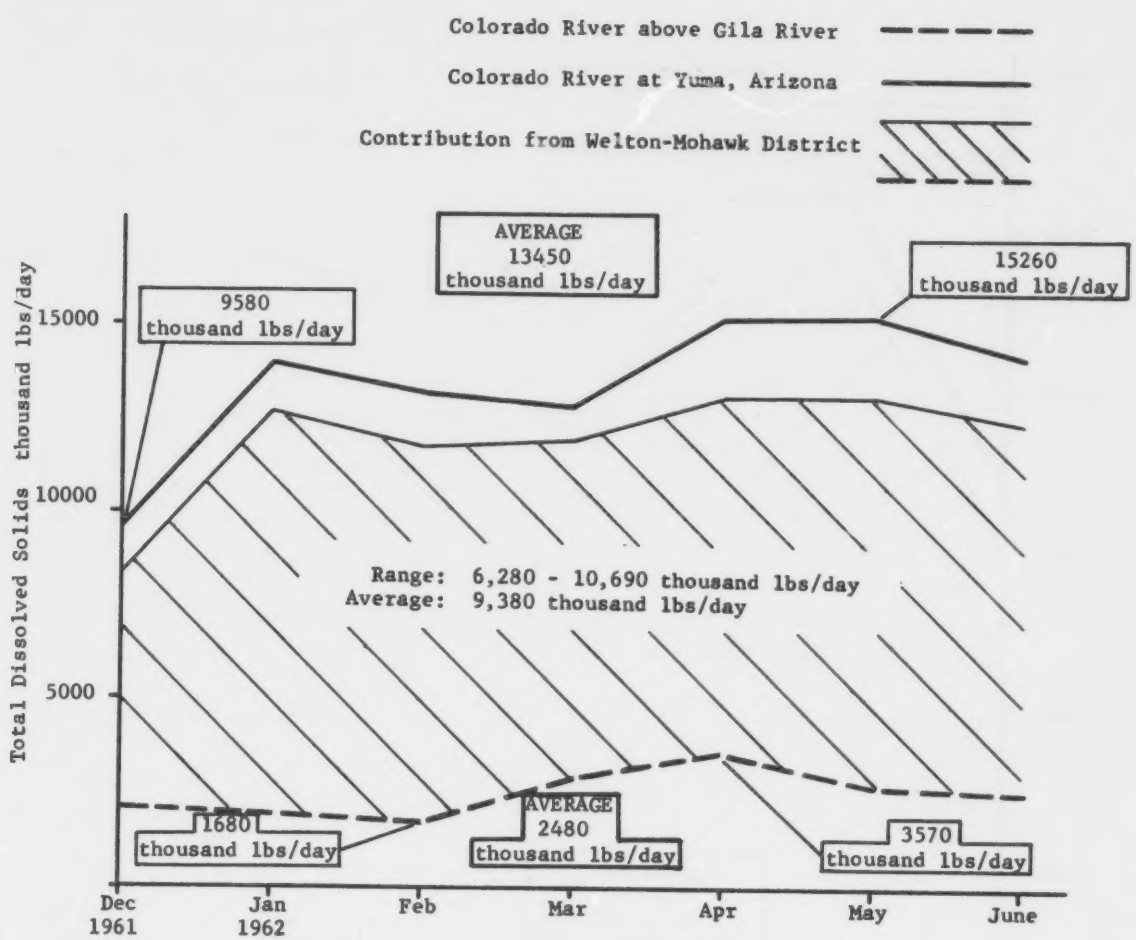


Figure 3

YUMA, ARIZONA VICINITY SAMPLING NETWORK

Mean Monthly Chloride Loading, thousand lbs/day
December 1961 - June 1962

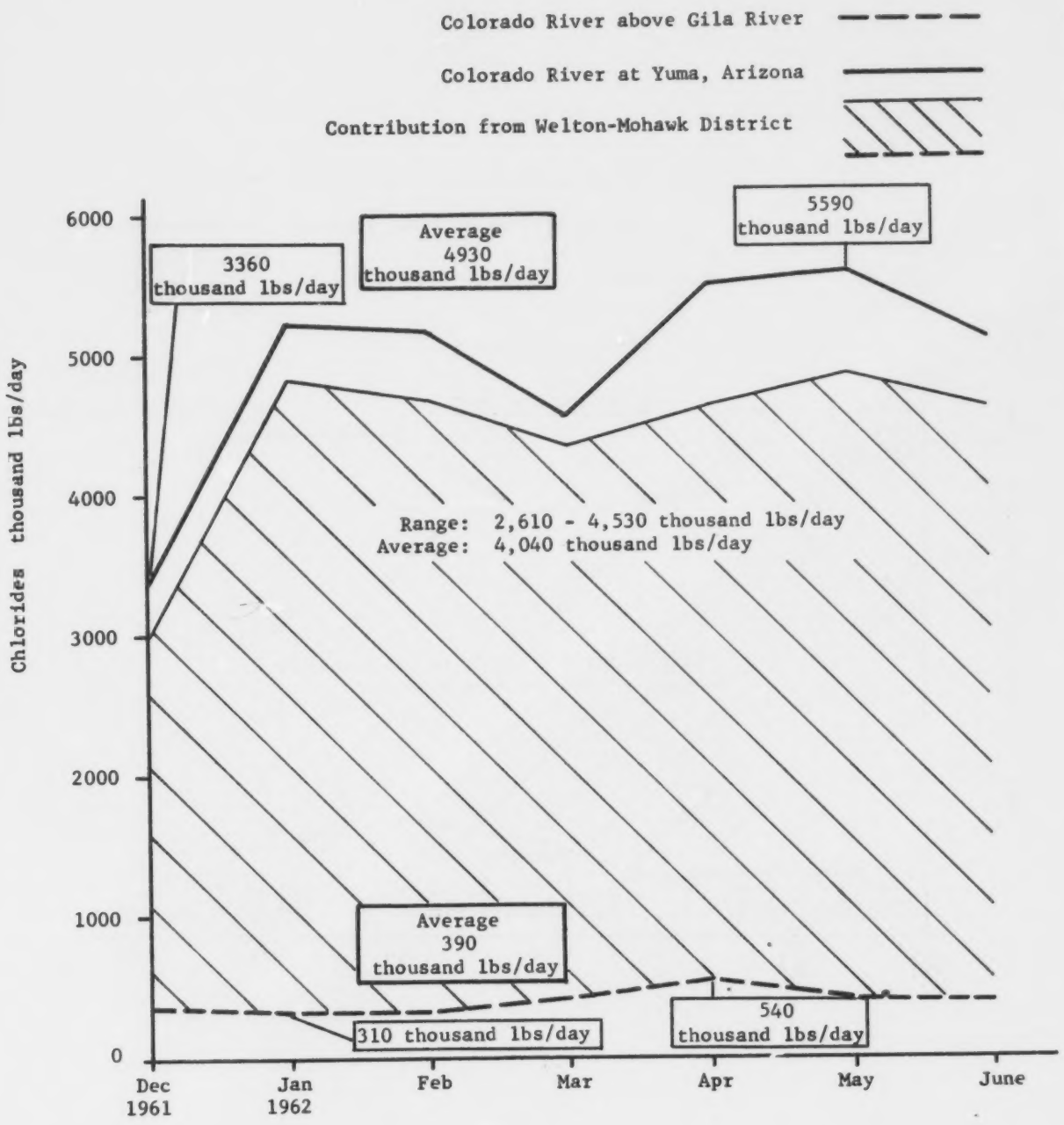


FIGURE 4

PROGRESSIVE INCREASE
DOWNSTREAM IN SALINITY
OF THE COLORADO RIVER

Average for Five-Year Period 1953-57

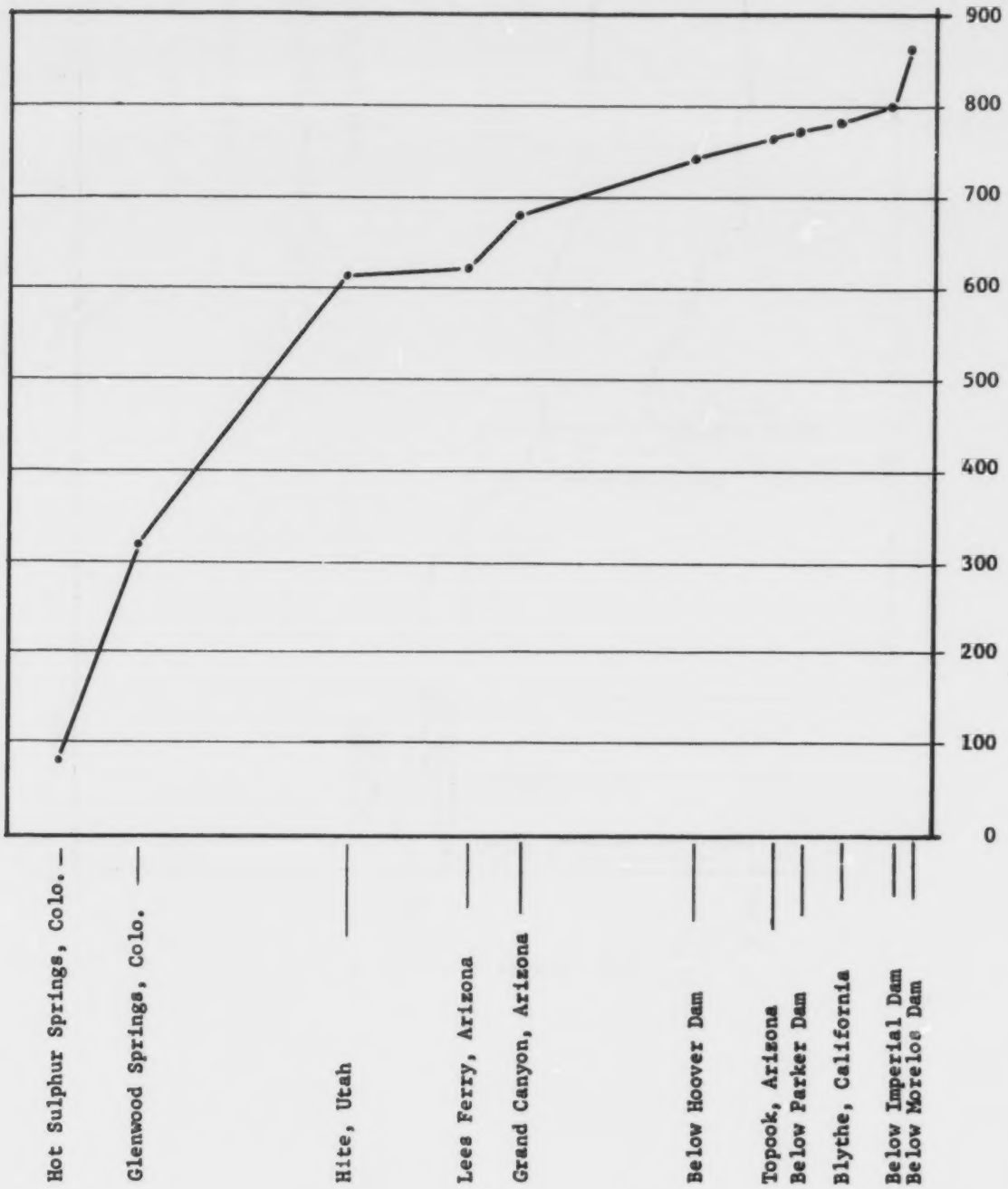


Figure 4A

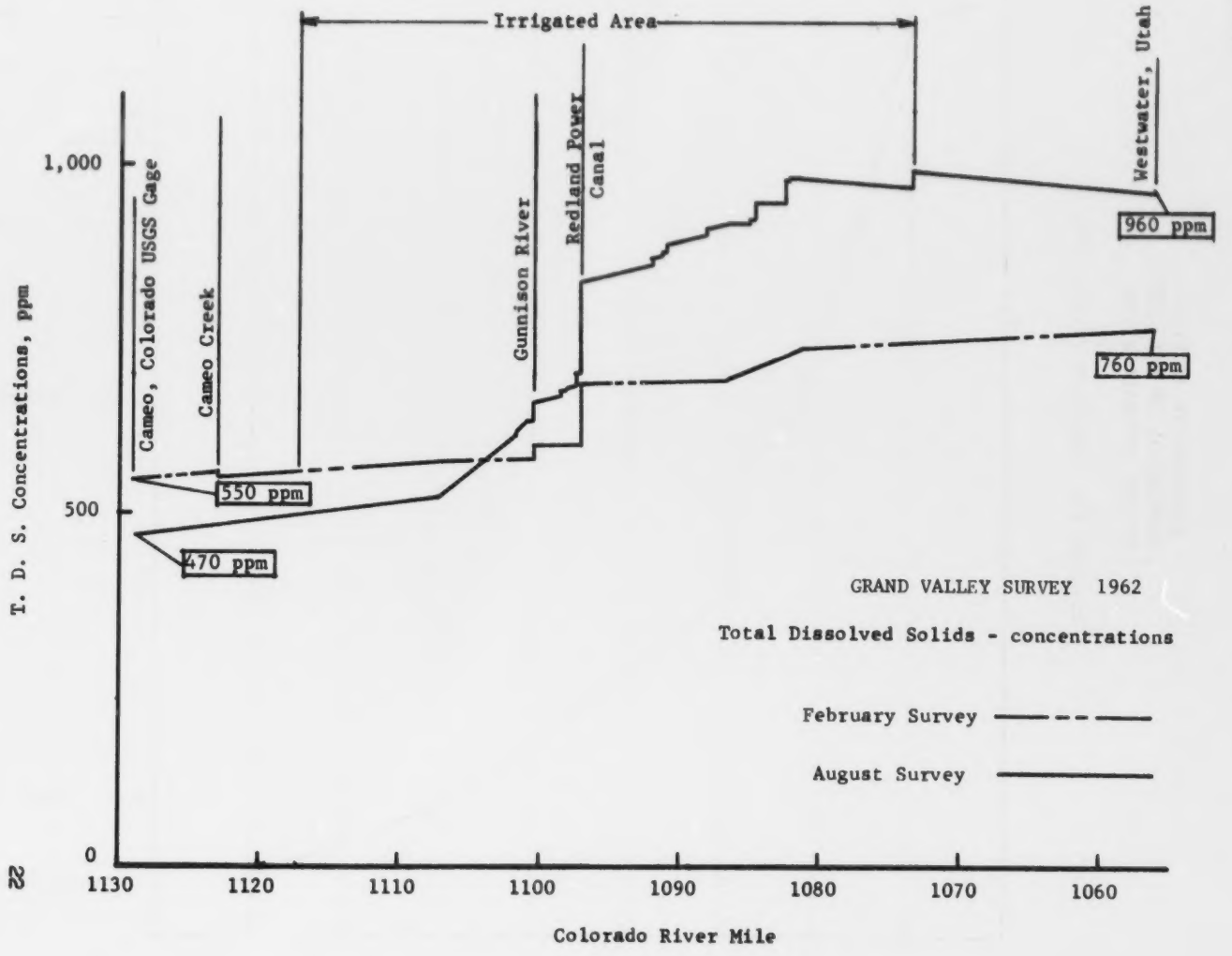

Irrigated Area
Cameo, Colorado USGS Gage
Cameo Creek
Gunnison River
Redland Power Canal
Westwater, Utah
960 ppm
760 ppm
550 ppm
470 ppm
1,000
500
0
T. D. S. Concentrations, ppm
1130
1120
1110
1100
1090
1080
1070
1060
Colorado River Mile
GRAND VALLEY SURVEY 1962
Total Dissolved Solids - concentrations
February Survey
August Survey

Figure 4B

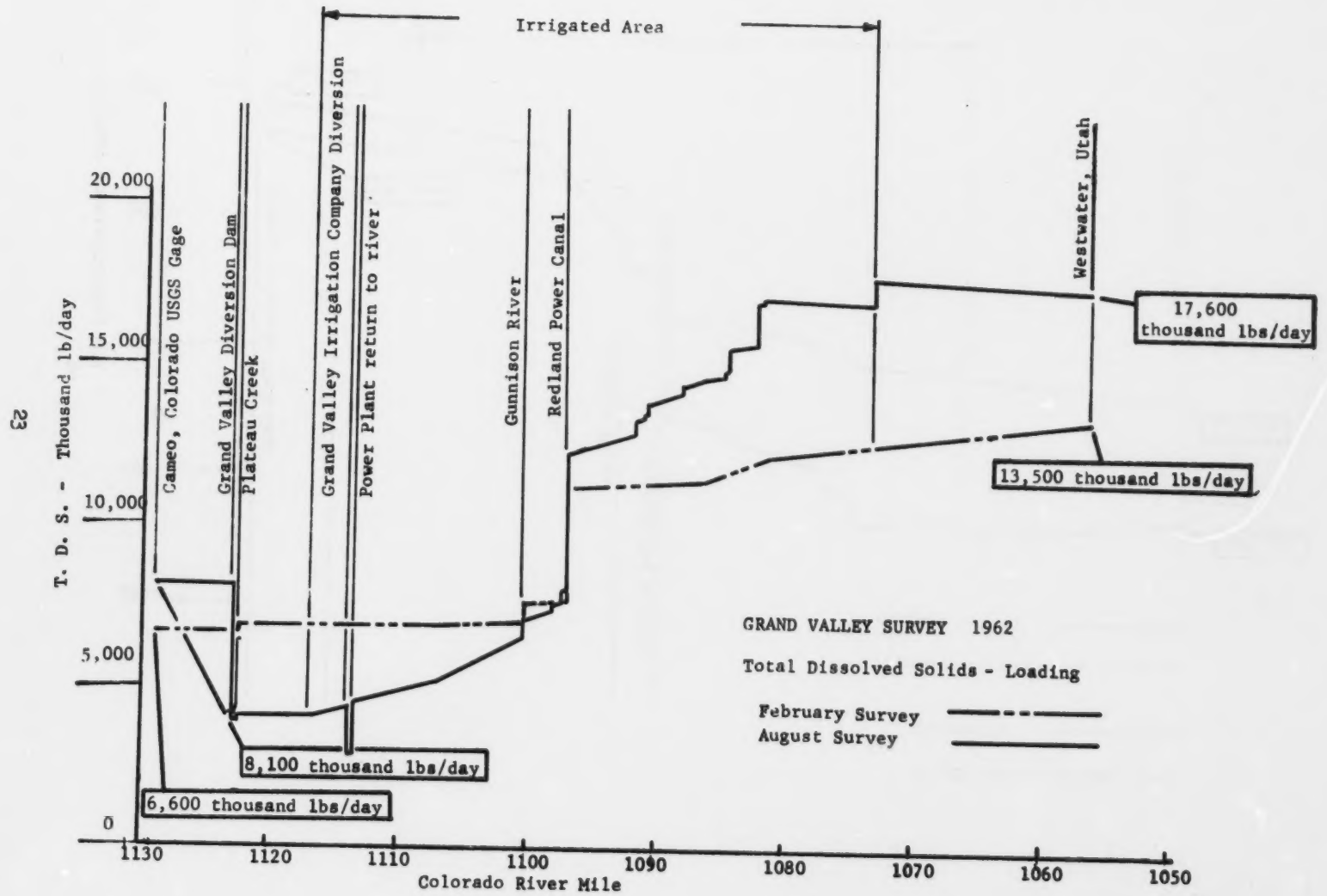

Irrigated Area
Cameo, Colorado USGS Gage
Grand Valley Diversion Dam
Plateau Creek
Grand Valley Irrigation Company Diversion
Power Plant return to river
Gunnison River
Redland Power Canal
Westwater, Utah
20,000
15,000
10,000
5,000
0
T. D. S. - Thousand lb/day
17,600 thousand lbs/day
13,500 thousand lbs/day
8,100 thousand lbs/day
6,600 thousand lbs/day
GRAND VALLEY SURVEY 1962
Total Dissolved Solids - Loading
February Survey
August Survey
1130
1120
1110
1100
1090
1080
1070
1060
1050
Colorado River Mile

Figure 4C

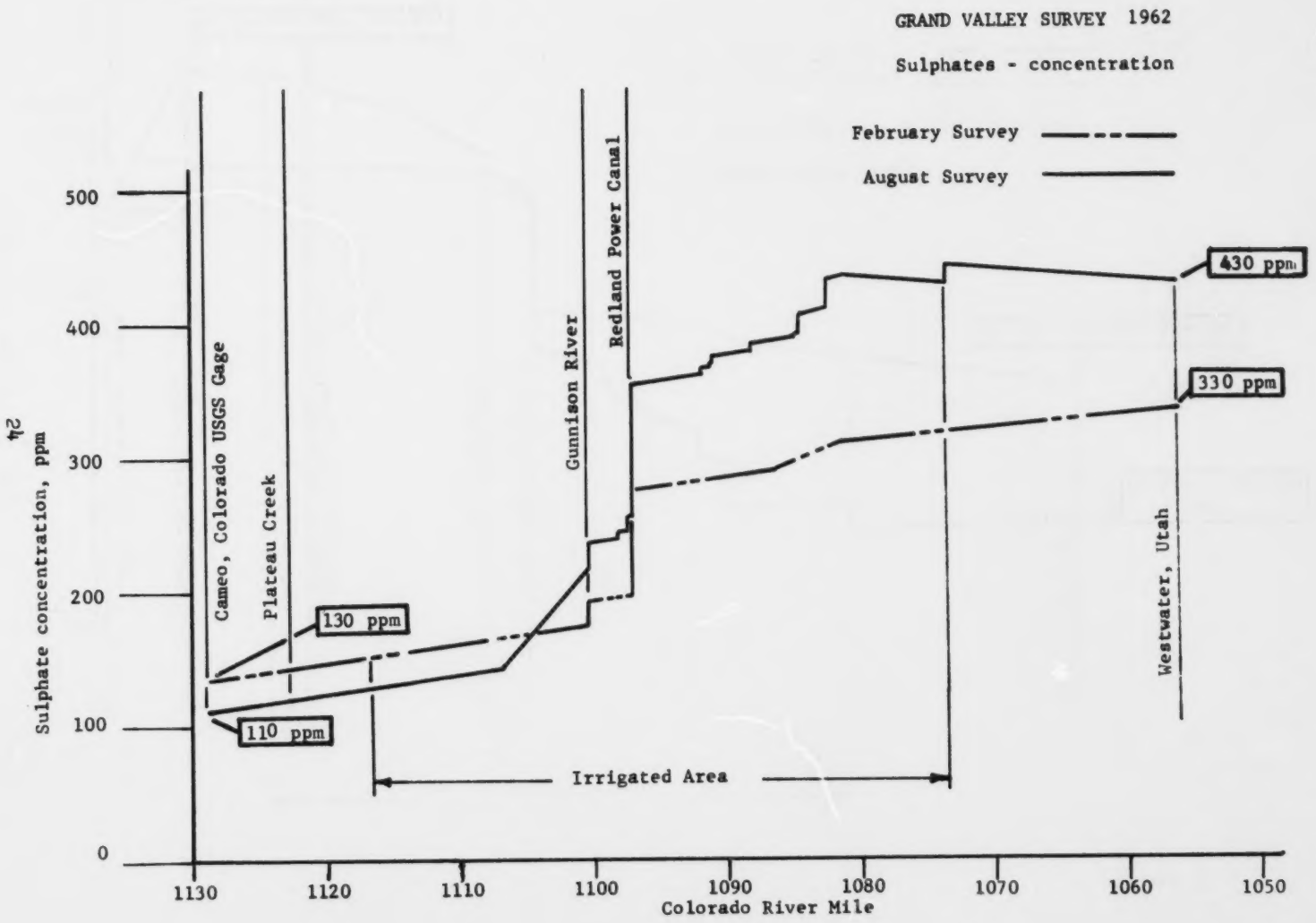

GRAND VALLEY SURVEY 1962
Sulphates - concentration
February Survey
August Survey
Sulphate concentration, ppm
500
400
300
200
100
0
Cameo, Colorado USGS Gage
Plateau Creek
Gunnison River
Redland Power Canal
Westwater, Utah
130 ppm
110 ppm
430 ppm
330 ppm
Irrigated Area
1130
1120
1110
1100
1090
1080
1070
1060
1050
Colorado River Mile

Figure 4D

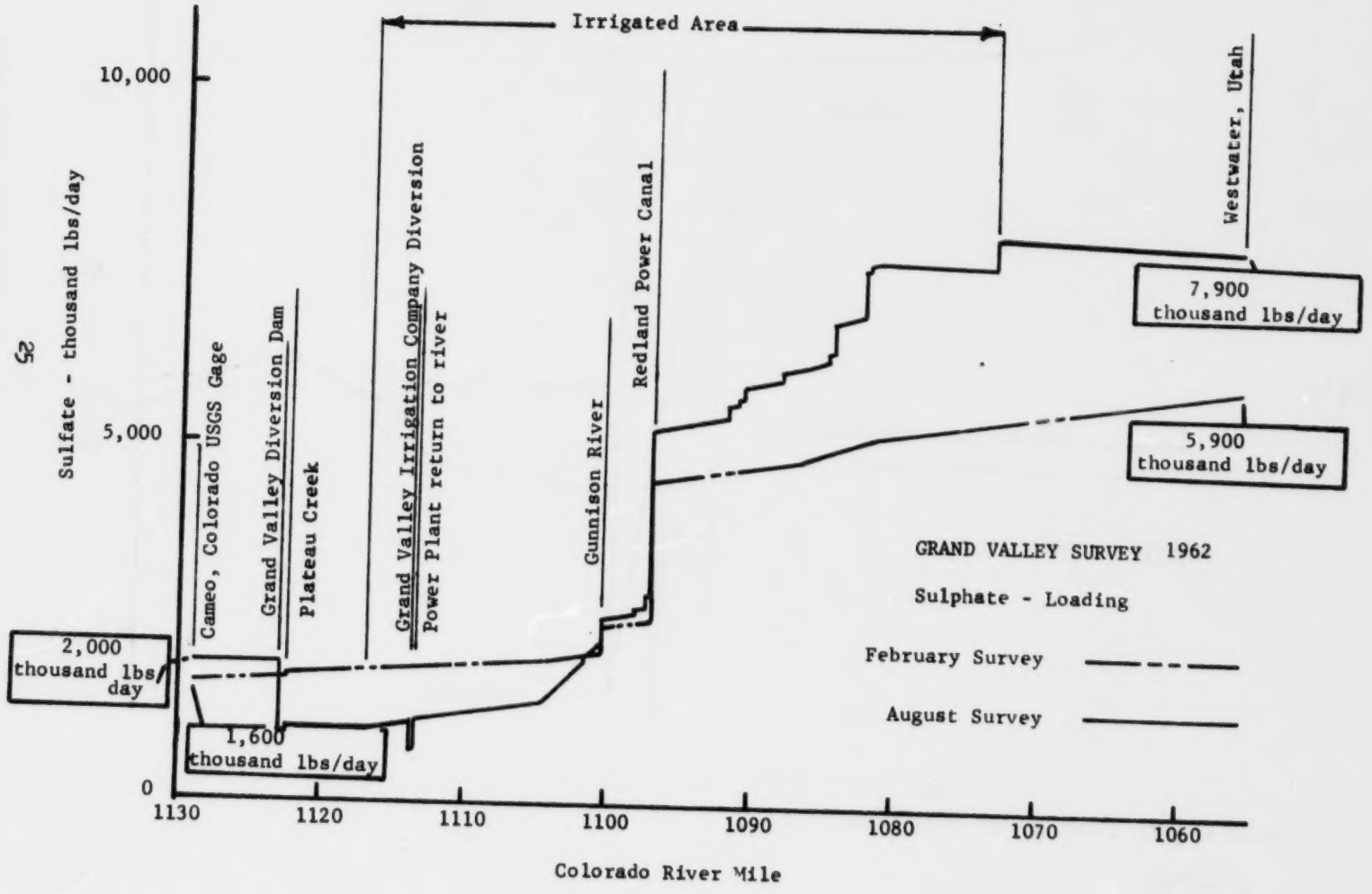

Irrigated Area
10,000
5,000
0
Sulfate - thousand lbs/day
Cameo, Colorado USGS Gage
Grand Valley Diversion Dam
Plateau Creek
Grand Valley Irrigation Company Diversion
Power Plant return to river
Gunnison River
Redland Power Canal
Westwater, Utah
7,900 thousand lbs/day
5,900 thousand lbs/day
2,000 thousand lbs/day
1,600 thousand lbs/day
GRAND VALLEY SURVEY 1962
Sulphate - Loading
February Survey
August Survey
1130
1120
1110
1100
1090
1080
1070
1060
Colorado River Mile

FIGURE 5

DOLORES-SAN MUGUEL RIVERS WATER QUALITY STUDY

March 12-23, 1962

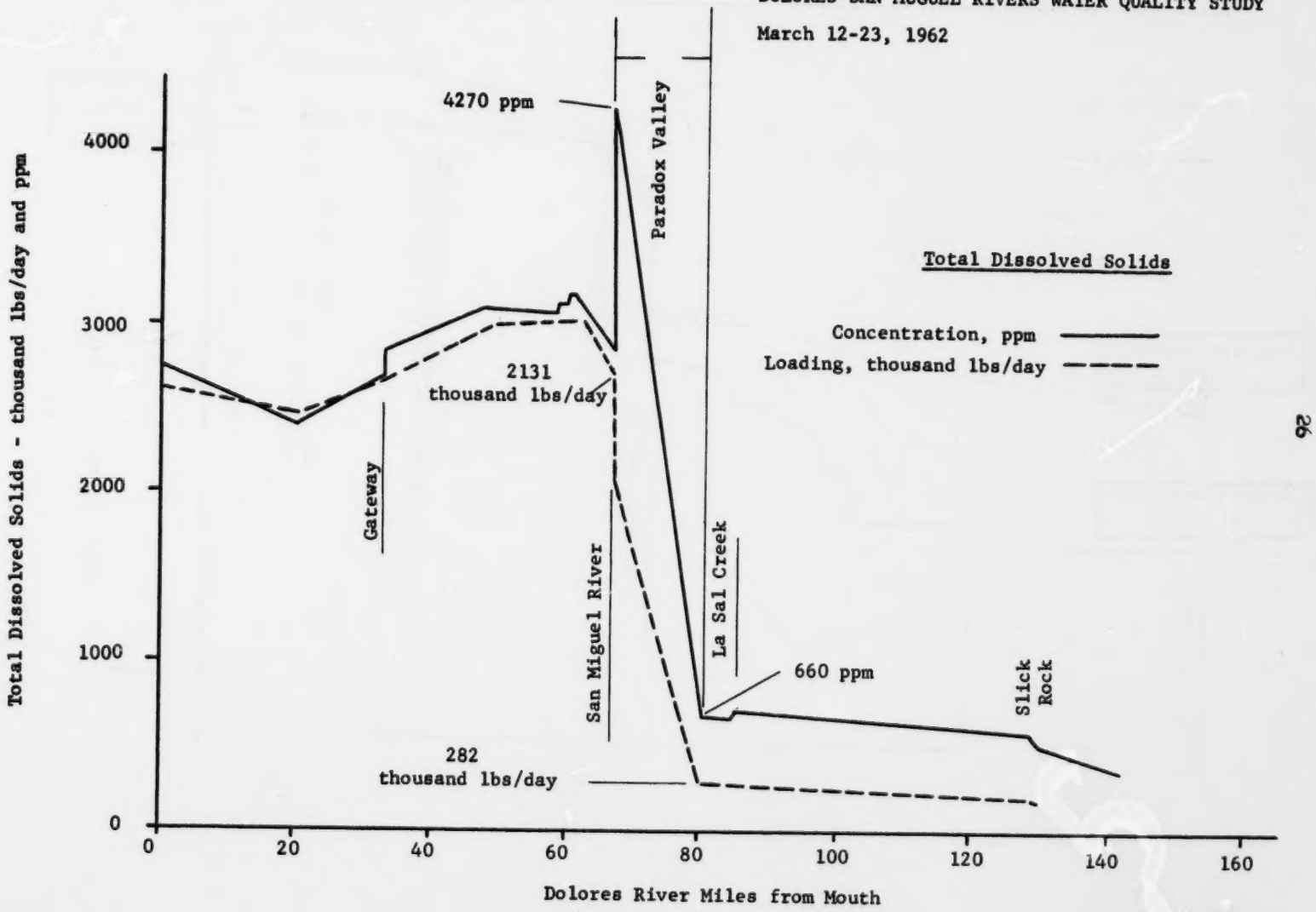
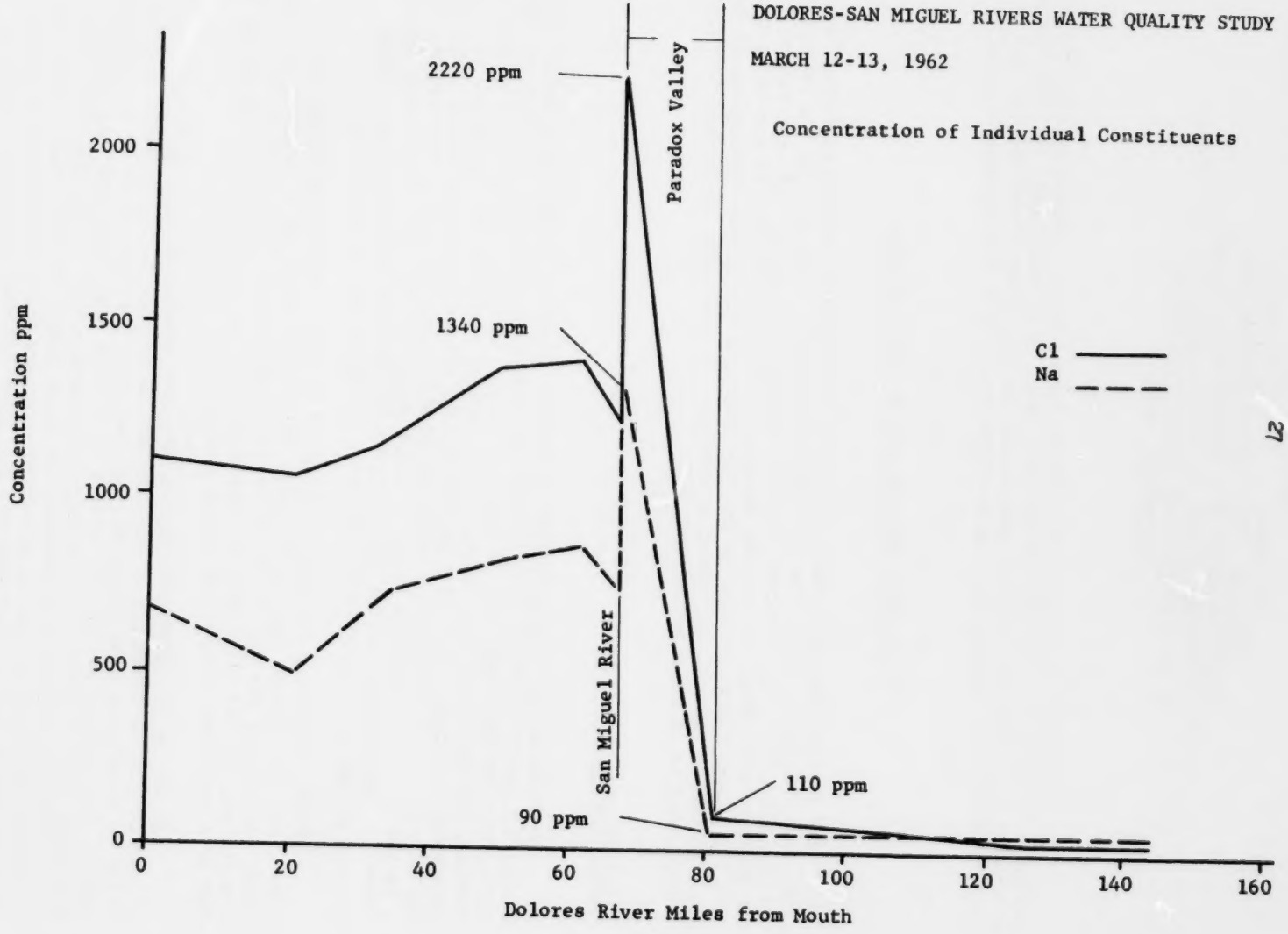


FIGURE 6

DOLORES-SAN MIGUEL RIVERS WATER QUALITY STUDY

MARCH 12-13, 1962

Concentration of Individual Constituents



STATEMENT OF
DR. ERNEST C. TSIVOGLOU, CHIEF
PHYSICAL & ENGINEERING SCIENCES UNIT
TECHNICAL ADVISORY & INVESTIGATION SECTION
UNITED STATES DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE
R. A. TAFT SANITARY ENGINEERING CENTER
CINCINNATI, OHIO

DR. TSIVOGLOU: I would first like to summarize and discuss briefly the radiological activities and findings of the past year. Following that, it seems opportune to briefly summarize the progress made since the beginning of the Project three years ago, and finally to outline the future radiological work that appears desirable.

ACTIVITIES AND FINDINGS OF THE PAST YEAR

The Project has conducted a number of radiological activities during the past year, some relatively extensive and some exploratory. They include the radium water and sediment monitoring networks, initial uranium monitoring, and exploratory Pb-210 and thorium monitoring, as well as certain limited special studies and participation with the Atomic Energy Commission and the uranium mills in the development of accident prevention criteria and alerting systems. I would like to discuss briefly the salient results of these activities.

RADIUM MONITORING NETWORK

A total of 380 Radium Monitoring Network samples, representing collections during the period February 1962 through January 1963, have been analyzed for Ra-226. During this period there were 24 active Network stations. Except for the more recent results, the data have been released on a regular basis to the Conferees and other interested agencies. The first report of such data was made in October 1962, when the backlog of analytical work began to clear up, and the second data report was released in January of this year. A third report of the most recent data is due shortly. The results for the twelve-month period noted above present a clear picture of the quality of Basin waters so far as Ra-226 is concerned.

First, regarding the generally accepted limits for Ra-226 dissolved in water, all 380 results were at or below the average limit of 3.3 micromicrocuries per liter established several years ago by the International Commission on Radiological Protection, and for all practical purposes there was no significant departure above the Drinking Water Standard of 3.0 micromicrocuries per liter.

It may be recalled also that at the last session of this Conference it was suggested that an objective of no more than an average of 1.0 micromicrocuries per liter of Ra-226 was both reasonable and desirable for the waters of the Colorado Basin. The primary reasons for selection of this limit were adequate protection, in the sense that Ra-226 is not the only radioisotope that we are concerned with; and reasonableness, in that the available evidence indicated that such a limit would not be unduly difficult or costly to achieve. We are therefore pleased to report that this average of 1.0 micromicrocuries per liter has been essentially achieved.

Of the 380 results noted above, a total of 26 individual samples, or about 7 percent, contained slightly more than 1.0 micromicrocuries per liter. Of these, 24 occurred in samples from the San Miguel-Dolores River system, specifically below Uravan, Colorado. In that case, however, the results show improvement since September 1962, and average Ra-226 concentrations have been below 1.0 micromicrocuries per liter since that time.

During the twelve-month period ending February 1963, a total of 69 of the 380 Ra-226 determinations were at unpolluted, or background, locations. The range of these results was quite small, from 0.01 to 0.26 micromicrocuries per liter, with an average of 0.07 micromicrocuries per liter. The average Ra-226 concentration at the northerly United States-Mexican border was 0.15 micromicrocuries per liter, not significantly different from the natural level.

The contributions of the uranium mill to the Ra-226 burden of the waters of the Colorado Basin, while relatively small at this time, are detectable by the Network surveillance system. Comparisons of average Ra-226 concentrations at river stations above and below some of the mills are shown in Table I. In addition to providing a good estimate of the Ra-226 contribution from the mill involved, these data also demonstrate the high degree of sensitivity of the Network system.

As may be seen from the data, average increases of as little as 0.10 micromicrocuries per liter dissolved Ra-226 are detectable. It should be noted also that in some cases, especially the San Miguel and Dolores Rivers below Uravan, the increase of dissolved Ra-226 may be in part the result of leaching of residual river bed tailings deposits, rather than direct release from the mill.

The Project also began analyzing Network water samples for uranium during the year, and Table I also includes results of these analyses. A total of 152 samples were analyzed for uranium, of which 26 were samples from unpolluted locations. These natural uranium concentrations averaged 3.1 micrograms per liter, with a range of 0.6 to 8.3 micrograms per liter. As may be seen in Table I, the contributions of uranium to rivers near the mills are readily detectible, and the observed increases are comparable in relative magnitude to the observed Ra-226 increases. The observed river concentrations of uranium are far below the permissible, or safe limits.

Thus, the Radium Monitoring Network, which came into full operation during the past year, has proved to be a highly useful and sensitive system for surveillance, and has demonstrated that a high level of protection of the waters of the Basin has been achieved through the cooperative efforts of the uranium milling industry and the various agencies concerned.

SEDIMENT MONITORING

As indicated at the last session of the Conference, the monitoring for Ra-226 in the river sediments has been continued on a restricted basis. Earlier work provided a close estimate of the natural Ra-226 content of river sediments, at an average of 1.3 micromicrograms Ra-226 per gram sediment, and ranging up to a little more than 2.0 micromicrograms per gram. During October 1962 sediment collections were made at 43 river locations in the Basin and from two dry washes below uranium mills. Most of the 43 river sampling points were below one or more uranium mills.

The range of Ra-226 concentrations in the 43 river sediments was from 0.3 to 5.0 micromicrograms Ra-226 per gram sediment. The average of the 43 results was 1.3 micromicrograms per gram, or the same as background. Only a single result exceeded

effluents of 2,000 micromicrocuries per liter of Th-230, and the ICRP limit of 670 micromicrocuries per liter in water for domestic use. Other studies, to be discussed later, indicate, however, that the thorium from one of the mills (Uravan) is present in the acid effluents and precipitates upon being mixed with the alkaline river water. It was not found in large concentrations dissolved in the river water. The Project and the Division of Licensing and Regulation of the Atomic Energy Commission have the potential thorium problem under study.

CROP STUDIES

At earlier Sessions of this Conference we have commented briefly on the subject of Ra-226 uptake by crops, and it has been noted that cattle feed crops such as alfalfa, hay, and pasture grass appear to concentrate Ra-226 to a considerably greater degree than other crops. We noted results at the last Session as high as 1,160 micromicrograms per kilogram of Ra-226 in pasture grass, and commented that in general the Ra-226 content of crops appeared to be related primarily to topsoil rather than irrigation water Ra-226 concentrations.

This work has been limited largely because of the priority of other studies noted in this discussion. However, during the past year a small additional number of exploratory samples, primarily of feed crops, and milk, have been collected and analyzed. A few samples of fertilizer have also been analyzed.

Considering all of the available data so far obtained, the feed crops, primarily alfalfa, contained an average of 18 micromicrograms Ra-226 per kilogram of live material, for 23 samples from farms located above or away from likely uranium mill pollution. An average of 160 micromicrograms Ra-226 per kilogram live weight resulted from analysis of 28 samples from farms located below possible uranium mill pollution. The first group had a range as high as 60 micromicrograms Ra-226 per kilogram, whereas the second group ranges up to 1,160 micromicrograms per kilogram. Some of the higher results in the second group are, however, associated with farms not now ostensibly using contaminated irrigation water, while also results as high as 60 micromicrograms per kilogram were not expected in the so-called background group. Thus, although they present a reasonably clear picture, the results are not as highly consistent as expected.

This, coupled with other evidence from our National Water Quality Network, led to the examination of a small number of fertilizers for Ra-226 content, as it is well known that uranium often occurs in higher than ordinary amounts with phosphate deposits. Seven samples were collected last fall and analyzed. Three of them, referred to as "treble superphosphate," contained an average of 34 micromicrograms Ra-226 per gram of sample. One ammonium phosphate-sulfate contained 3.2 micromicrograms Ra-226 per gram, and one ammonium nitrate fertilizer had only 0.03 micromicrograms Ra-226 per gram. These samples were collected at farms in the Colorado Basin. Two others from Columbia River Basin farms were assayed for gross alpha activity. One, containing no phosphate, had a gross alpha of 3 micromicrocuries per gram, indicating perhaps 0.5 micromicrograms Ra-226 per gram or less. The other, an orthophosphate, had a gross alpha of 43 micromicrocuries per gram, and most probably contained considerably more Ra-226.

Ten milk samples have been analyzed for Ra-226. Four from "background" location farms had an average Ra-226 content of 0.14 micromicrograms per liter, or very low, with a range of 0.07 to 0.24 micromicrograms per liter. Four from other farms contained an average of 3.1 micromicrograms Ra-226 per liter, or about twenty times more than the first group. These data ranged from 1.6 to 4.8 micromicrograms Ra-226

per liter. Of course, these data are from isolated locations and not representative of any wide area. In spite of the small number of samples involved, however, the second group of results cannot be considered insignificant, and they indicate a need for more thorough followup.

ACCIDENT PREVENTION AND WARNING SYSTEMS

As noted last year, we have had some number of accidental releases of the contents of mill tailings ponds due to undermining and rupture of the pond walls. Two such incidents, one in the Colorado Basin at Mexican Hat, Utah, have occurred since our last Session. Again, in this case, no significant hazard to human health resulted, but one cannot guarantee that this will always be so, nor that harm to aquatic life will not result.

Accordingly, and per its instructions of last year, the Project has participated in the joint development of a set of construction criteria for tailings pond walls with the Division of Licensing and Regulation of the Atomic Energy Commission. An alerting system has also been set up by the AEC, by which it is hoped that both the State Water Pollution Control Agency and the Project will be notified immediately should an accident happen.

I believe that the alerting system has been in operation for several months now. The draft construction criteria have been sent to the Conferees and the mills for review and comment.. The Conferees' comments have been forwarded to the AEC. The detailed construction criteria were largely drafted by Division of Licensing and Regulation personnel, Therefore, I would rather not discuss them further now, but instead I am sure that Mr. Nussbaumer of that group intends to do so later today, and to tell you how these systems will work. The criteria are for existing as well as new construction, and some judgment will be required as to whether any protective modification of existing pond walls is desirable. Some of the mills have, I believe, undertaken some such protection measures in the past. Perhaps they or Mr. Nussbaumer may comment also on this point.

This summarizes our progress so far as accident control is concerned.

SPECIAL SURVEYS

Additional brief field studies have been made in the Monticello, Utah, and Uravan, Colorado, areas, to follow progress in improving those situations.

Monticello

The Atomic Energy Commission completed its work to confine the tailings from the closed uranium mill at Monticello during the past year. The improvement at the site has been extensive, as evidenced both by recent visual observation and field sampling of Montezuma Creek below the site. I am sure a representative of the Atomic Energy Commission will discuss the site improvement program a little later. I would like to discuss our recent survey findings at this point.

A total of five sampling runs for water and sediments have been made in Montezuma Creek. They date back to November 1961, and the most recent was on March 31 of

the upper limit of the range of natural Ra-226 concentrations. That result, 5.0 micromicrograms per gram near the mouth of the Dolores River, while not unduly high, is indicative of the sensitivity of the surveillance system. An additional small number of sediments analyzed as a part of later special studies of the San Miguel-Dolores system and of Montezuma Creek will be discussed a little later.

Also, in the fall of 1962 fourteen sediment samples taken from six lakes at relatively high elevations in the mountains were analyzed for Ra-226 for purposes of comparison to Ra-226 concentrations in the river samples. For this group, an average result of 1.9 micromicrograms of Ra-226 per gram sediment was obtained, with a range of 0.8 to 3.3 micromicrograms per gram. The two highest results were from the two samples from one lake; and, excluding these results, an average Ra-226 concentration of 1.7 micromicrograms per gram, with a range of 0.8 to 2.5, was obtained. These results, then, are in quite good agreement with the observed natural Ra-226 concentrations at unpolluted river sampling stations.

SPECIAL RADIOCHEMICAL ANALYSES

In accordance with plans to explore the occurrence of Pb-210 in the uranium mill effluents, a group of nine different effluent samples from five uranium mills were collected in the fall of 1962. This radioisotope is a late member of the uranium-radium family of elements, having an MPC in water for public consumption of 33 micromicrocuries per liter, considering the kidney as the critical organ. At about the same time it came to our attention through the Atomic Energy Commission that in some cases, particularly the Uravan mill, there might be relatively large amounts of thorium in the wastes. The laboratory investigated available techniques for analysis for these radioisotopes and developed the necessary capability, and the above set of effluent samples was subjected to a relatively intensive analytical process, including gross radioactivity, Ra-226, Pb-210, uranium, and thorium.

The Pb-210 concentrations in the nine mill effluents, before dilution by the receiving water, ranged from 2.3 to 570 micromicrocuries per liter, as compared to the MPC after dilution of 33 micromicrocuries per liter, and the Atomic Energy Commission Part 20 limit of 100 micromicrocuries per liter. The high result of 570 micromicrocuries per liter is for an effluent that does not normally overflow to a surface stream (Maybell, Colorado). The next highest concentration was 150 micromicrocuries per liter, from the Rifle, Colorado, mill. The remaining six values were all less than 20 micromicrocuries per liter of Pb-210.

Five Radium Monitoring Network water samples were also analyzed for Pb-210. The observed concentrations ranged from 0.02 to 0.22 micromicrocuries per liter, far below the permissible limit noted above.

Ra-226 concentrations observed in the nine effluents ranged from 1.8 to 92 micromicrocuries per liter, the high value being again an effluent not normally released to surface waters. These results were in agreement with our usual experience regarding Ra-226 in mill effluents. Uranium in the effluents ranged from 95 to 34,000 micrograms per liter, the latter result being unusually high. Later samples from this mill (Uravan) contained considerably less uranium.

Thorium concentrations in the effluents ranged from as little as 20 micromicrocuries per liter, to a high of about 300,000 micromicrocuries per liter, with three results in the neighborhood of 25,000 micromicrocuries per liter. The bulk of this activity was Th-230 (95 percent), as verified by alpha particle energy analysis. These are relatively high, compared to the Atomic Energy Commission Part 20 limit for licensee

this year. The data indicate a steady improvement since a year ago. For example, within and just below the tailings area, the Ra-226 content of Montezuma Creek has decreased from an average of 4.9 micromicrocuries per liter in April 1962 to 0.75 micromicrocuries per liter in March of this year. The improvement is not so marked at Sorenson farm yet, but the concentrations have dropped to less than half of their former values farther downstream.

Sediment Ra-226 concentrations near and just below the mill have decreased from 210 micromicrograms per gram a year earlier to an average of 37 micromicrograms per gram last March. The observed value at Sorenson Farm in March was about 40 percent of the earlier level, and only slight residual contamination remains farther downstream.

Thus, the beneficial effects of the site improvement program at Monticello are definite so far as the protection of Montezuma Creek is concerned. The residual contamination will undoubtedly diminish more slowly, but it is not at levels that we need be seriously concerned with.

Uravan

The Union Carbide Nuclear Company has been engaged for some time now in efforts to reduce radioactivity releases to the San Miguel-Dolores River system. Recently a small new lagoon has been placed in operation to evaluate the possibility of evaporation and seepage as a means of disposal of some of the effluent. I am sure that a company representative will discuss this and other recent data a little later. The Vanadium Corporation of America was also active for much of the past year at its old Naturita site above Uravan on the San Miguel, but I understand has again moved these operations elsewhere.

Several brief field surveys of the streams involved have been conducted by the Project during the past year, the most recent being in early February of this year. The results of that survey indicate that so far as dissolved radioactivity is concerned, the rivers were at a quality level comparable to other parts of the Colorado system. Specifically, dissolved Ra-226, Uranium, Pb-210, and Th-230 were all at low levels. The only dissolved Ra-226 result very slightly higher than 1.0 micromicrocuries per liter was in the Dolores River, and our recent surveys indicate that part of that quantity of Ra-226 came from LaSal and Mesa Creeks, rather than from mill pollution. The sediments still show evidence of a low level of contamination, both of Ra-226 (up to 10 micromicrocuries per gram), and thorium (30 micromicrocuries per gram) at locations several miles below the Uravan mill.

Three effluents that were analyzed contained relatively low levels of Ra-226, uranium, and Pb-210, so far as safe amounts are concerned. Two of the effluents were highly acid and contained substantial quantities of thorium compared to allowable amounts. However, on mixing with the alkaline river water, the thorium precipitated in the San Miguel, apparently almost at once. Thus, no immediate hazard was present, although the accumulation of this long-lived material (half-life about 80,000 years) on the river bed is not desirable. Neutralization of these effluents before release to the river, and retention of the precipitate, would eliminate the thorium discharge, as well as the unsightly floc that is present, and should markedly reduce the chemical toxicity of the mill waste releases.

SUMMARY OF PROGRESS TO DATE

As indicated by the data already presented, especially that from the Radium Monitoring Network, the rivers of the Colorado system are all now in excellent condition so far as Ra-226 is concerned. At our first Session, in January 1960, we reported random Ra-226 concentrations in the main Colorado up to 5.5 micromicrocuries per liter, and in tributaries up to 60 micromicrocuries per liter. Effluent concentrations up to 1,000 micromicrocuries per liter had been found, and substantial contamination of the river sediments had occurred. Radioactive pollution of the river system was then regarded as the most pressing Basin problem requiring control.

As noted earlier today, our sampling networks indicate that at this time all of the surface waters of the Basin contain average Ra-226 concentrations of less than 1.0 micromicrocuries per liter, the desirable goal that we sought. The sediments, with a few minor exceptions, contain essentially natural quantities of Ra-226. We have together developed approaches that should effectively prevent accidental spills of tailings pond contents.

This is an impressive record of industry-wide pollution abatement, achieved in a relatively short period of time by the sincere cooperation of the industry and the several State and Federal agencies concerned. It is especially impressive in that the degree of water quality protection that has been achieved is considerably greater than would be necessary on the basis of existing numerical standards for Ra-226 alone.

Certain minor problems remain, as indicated by the material presented earlier, and including the problem of chemically toxic effluents, but these are only partially industry-related and should not detract from the real progress that has been made.

FUTURE RADIOLOGICAL ACTIVITIES

The desirable future radiological activities of the Project are reasonably clear from the foregoing material. Primarily, the Radium Monitoring Network should continue with some modification, and certain other limited studies should be conducted during the coming year.

The surveillance network serves the purpose of accident detection as well as evaluating average radioactivity levels. Now that sample collection is in full operation, the analytical phase should be extended somewhat to include monitoring for other significant radioisotopes associated with uranium milling. Uranium monitoring began last December at all stations, and one small set of Pb-210 analyses has been performed. In the future it appears that a desirable minimal program should include monitoring for gross alpha activity, uranium, Pb-210, and thorium routinely at eight locations selected from the group of active Network stations. Two of these should be background stations, and their locations should be shifted regularly, say every six months, to other background stations. In addition, at an estimated six other Network stations, analysis should include Sr-90, gross beta activity, and a gamma scan to evaluate the amount of radioactive fallout present in the Basin. With the exception of perhaps three or four stations, at which the weekly variability of radioactivity levels should be evaluated, it appears that monthly compositing and analysis of samples should suffice for the coming year. Sediment monitoring for gross alpha activity and Ra-226 at the reduced number of sediment sampling points should continue on a twice-yearly basis, in the fall and late spring. This program should not greatly increase the laboratory analytical load, but should considerably increase the effectiveness of the surveillance network

In regard to the radioactivity surveillance network routine thorough inorganic chemical analysis at some stations will be conducted in connection with other Project studies of salinity. The resulting data should prove quite useful in aiding complete interpretation of the radioactive quality data.

In view of the findings of the past year, all mill effluents should be sampled for Pb-210 and thorium once initially, with additional subsequent sampling at mills where it proves desirable. The San Miguel River sediments in the immediate vicinity of Uravan should be sampled and monitored to evaluate the extent of thorium contamination. At Monticello, Utah, an additional series of water and sediment samples from Montezuma Creek, taken next winter, should suffice to evaluate the existing stream quality and the effects of the site improvements.

The question of residual contamination of farmlands and of the related effects of the use of phosphate fertilizers should be studied in somewhat more detail, so far as Ra-226 contamination of feed crops and milk is concerned. This can be accomplished by studies at four or five selected farms with collection, compositing and analysis of representative samples of topsoil, fertilizer, alfalfa and milk, and with collection of information as to fertilizer application rates, irrigation rates, etc.

Finally, it appears that we have reached a point at which the problem of ultimate disposal of uranium mill tailings should be given more serious consideration. Their radioactivity is very long-lived. Occasional questions as to their suitability for land-fill operations and for highway subgrade material have gone unanswered. Field studies are not proposed at this time, but rather it is proposed that the industry as well as the responsible local and Federal agencies attempt to develop a rational approach to the long-term protection and containment of tailings piles as well as rational evaluation of proposals for their possible disposal by uses such as those noted above.

Table I. Ra-226 and Uranium Contributions from Uranium Mills

Station	Location	Radium		Uranium	
		Number of Samples	Average Dissolved Ra-226, μμc/l.	Number of Samples	Average Dissolved Uranium, μg/l.
9	Colorado R., above Moab, Utah	24	0.23	13	10
10	Colorado R., below Moab, Utah	25	0.33	14	13
11*	Animas R., above Durango, Colo.	10	0.06	3	1.1
12	Animas R., at Colo.-N. Mex. Line	26	0.40	11	6.7
15	San Juan R., above Mexican Hat, Utah	14	0.14	2	8.9
16	San Juan R., below Mexican Hat, Utah	20	0.24	2	11
17*	San Miguel R., above Naturita, Colo.	19	0.05	4	1.1
18	San Miguel R., above Uravan, Colo.	36	0.28	18	12
20	San Miguel R., below Uravan, Colo.	37	0.71	17	39
21(1)	Dolores R. at Bedrock, Colo.	12	0.38	4	11
26(2)	Dolores R. at Gateway, Colo.	36	1.39	-	-
26(3)	Dolores R. at Gateway, Colo.	21	0.94	18	7.8

*Background locations.

(1) Below Slick Rock mine.

(2) Period of 1/29/62 - 2/2/63

(3) Period of 9/24/62 - 2/2/63

MR. STEIN: Thank you, Dr. Tsivoglou. Are there questions or comments?

MR. THATCHER: Dr. Tsivoglou, you think it was agreed that the guides as set for the radium here were based on the dissolved radium, and that it would be desirable because of the leachability of the radium to eliminate suspended radium from the effluents.

DR. TSIVOGLOU: That is correct.

MR. THATCHER: I am wondering if the monitoring system that is now in operation takes into account this fact in the determination of whether or not the removal of suspended material is adequate to protect us in this respect?

DR. TSIVOGLOU: Yes, I think it does, although it is not designed directly to do this. The sediment monitoring system has stations essentially above and below all of

the operating mills.

Primarily this collection of sediments in the early spring, before the onset of spring floods, I think, will demonstrate quite clearly whether there has been any substantial release of suspended uranium mill tailings which would contain radium.

MR. THATCHER: Thank you.

MR. STEIN: Mr. Williamson.

MR. WILLIAMSON: I noticed you mentioned doing further monitoring or sampling on uranium. What limits are we talking about on uranium? Nobody ever comes up with a concrete figure.

DR. TSIVOGLOU: There is a figure. I will quote it in the hope that it hasn't been changed. The figure for the safe concentration of uranium is based more on its chemical toxicity than on its radioactivity. I figured this out two or three years ago.

If they haven't changed it, it is still 21 milligrams per liter, parts per million. If you recall, the numbers I spoke of were in terms of micrograms per liter, or parts per billion.

MR. WILLIAMSON: That 21 milligrams per liter is going to be quite toxic to fish.

DR. TSIVOGLOU: I don't think any mill is going to lose that much uranium because it is too valuable.

MR. WILLIAMSON: But it will knock off the fish.

DR. TSIVOGLOU: Yes. I hold no brief for whether the 21 milligrams per liter is a good number. I think you are quite right about its toxicity to fish. It is the number suggested by the ICRP.

MR. STEIN: Is that number based on its effect on human-beings rather than fish?

DR. TSIVOGLOU: Yes, sir; that is correct.

MR. STEIN: Other comments or questions here?

MR. GAHR: Mr. Chairman, is it in order at this time to hear from any other representatives other than the conferees?

MR. STEIN: At this point?

MR. GAHR: Yes.

MR. STEIN: Off the record.

(Discussion off the record.)

MR. GAHR: Some of our industry representatives, I am sure, are interested in lead-210 and the methods and the results of those nine samples. At this time, if it is possible, Mr. Chairman, I would like to ask Mr. Beverly, if he wishes, to ask Dr, Tsivoglou any questions he may have. I see he is in the audience.

Perhaps he would like to speak to you now on that point? Mr. Beverly?

DR. TSIVOGLOU: I wonder if I may make one remark. If we are going to get into analytical methods on lead-210, I will not attempt to answer them; but I would prefer to call Dr. Rushing.

MR. GAHR: I really don't know what his questions will be.

DR. TSIVOGLOU: You mentioned methods. I don't know the methods for lead-210.

MR. STEIN: Mr. Beverly.

MR. BEVERLY: Mr. Gahr, thank you for the opportunity; but I think some of these detailed questions had better be handled personally by Dr. Rushing and Dr. Tsivoglou.

MR. STEIN: Thank you. I just had one more question for clarification, Dr. Tsivoglou. That last point on the ultimate disposal of uranium mill tailings: Is that a suggestion you are giving for the benefit of the country as a whole? Or do you want the conferees to make that suggestion for the country as a whole?

DR. TSIVOGLOU: What the conferees do here so far as uranium mill tailings are concerned will undoubtedly lead the way for other areas of the country. I am making the suggestion for the conferees, not for the entire United States -- although I expect it to be useful elsewhere.

MR. STEIN: Thank you.

STATEMENT OF
CHARLES E. SPONAGLE, PROJECT DIRECTOR
COLORADO RIVER BASIN WATER QUALITY CONTROL PROJECT
PUBLIC HEALTH SERVICE
UNITED STATES DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE
DENVER, COLORADO

MR. SPONAGLE: Previous speakers here have indicated the nature and extent of work undertaken by the Project since the last Conference Session and have summarized the situation with respect to radiological pollution in the Basin from the initiation of the Porject to the present time. As you know, at the time of the first Conference Session, pollution from the uranium milling industry was the most critical and pressing problem within the Basin. Because of this, emphasis was given to studies of this pollutant and dramatic improvements in radioactive quality of Basin waters have been made through joint efforts of the State water pollution control agencies, the U. S. Atomic Energy Commission, the Public Health Service, and the uranium milling industry itself. These improved conditions have continued in evidence over the past year. Consequently, in this area, the Project's activities have been reduced to the minimum consistent with adequate monitoring and surveillance of radium-226 levels in Basin waters and sediments and with limited surveillance of other radioisotopes, such as Pb-210 and thorium.

In view of this, the Project is now ready to direct principal attention toward another significant degradation of water quality which is apparent in the Basin, i.e., the total dissolved-solids content, or salinity, of the Basin's waters. It has been noted here that the headwaters of the Colorado River are of excellent quality in this respect, containing but 100 ppm or less of total dissolved solids. As the waters proceed downstream, there is a consistently increasing dissolved-solids content along the entire mainstem to the northerly U. S.-Mexican international boundary where average monthly total dissolved-solids concentrations during the past two years have exceeded 1,000 ppm and have been observed to go as high as 2,500 ppm.

Now, let us consider the causes contributing to this pattern of dissolved solids increase. In January 1963, the U. S. Department of the Interior issued a progress report "Quality of Water, Upper Colorado River Basin" (1).

In this report the Geological Survey assessed the water quality of the Colorado River and its tributaries as of 1957 above Lee Ferry, Arizona, the dividing point between the Upper and Lower Basins. Stated objectives were "...so far as was practicable ... to discriminate natural and man-caused components of the dissolved-solids load that was in the stream system as of 1957 and to scale the size of each major component ..." (2)

The Survey's assessment, as reported in the above publication, is a summary of detailed information contained in two reports which await publication. The methods by which these figures were developed are not clear, and the reports from which they have been taken are not yet available.

In order to clearly present and discuss the pertinent data, I have prepared it in tabular form, as shown in the next two slides. Could we have the first slide, please.

Before we discuss this data, I would like to point out one qualification which the Department of the Interior has made. All of these salinity estimates should be

judged merely as credible interim indicators associated with the general order of magnitude of the results shown.

Table I, shown in the slide, indicates the Survey's assessment of water yield and water quality at Lee Ferry under two conditions: (1) the situation as of 1957, with the then-existing facilities for storage, withdrawal, and use of the water; and (2) the situation estimated to exist had man's developments as of 1957 not been in existence, referred to as a "hypothetical virgin situation."

Considering these in the above order, as of 1957 the average water yield at Lee Ferry was about 12.7 million acre-feet per year. Average yearly dissolved-solids concentration was 501 ppm. Average dissolved-solids discharge, that is, the weight of dissolved solids passing this point, was about 8.7 million tons per year.

In the hypothetical virgin situation the corresponding estimates are as follows: Average yearly water yield, about 15.2 million acre-feet, an increase of some 2.5 million acre-feet; average yearly dissolved-solids concentration, 253 ppm, a decrease of 248 ppm; average dissolved-solids discharge, about 5.2 million tons per year, a decrease of some 3.4 million tons per year.

MR. STEIN: Mr. Sponagle, I must say that, in twenty years of experience in the field, your phrase "hypothetical virgin situation" is the most felicitous I have come across.

MR. SPONAGLE: I can't take the credit for that.

It is apparent that in the hypothetical virgin situation a substantial weight of dissolved solids would pass Lee Ferry each year, and there would be a significant increase in their concentration from the headwaters to this point. These increases can probably be ascribed to naturally-occurring sources of salinity in the Upper Basin, such as concentrated brines from springs occurring along the streams and natural saline discharges from ground-water reservoirs to the stream.

"In other words," the report states, "in relation to a hypothetical virgin situation, man's developments in the Upper Basin of the Colorado River appear to have diminished water yield about 16 percent, nearly doubled dissolved-solids concentration, and increased dissolved-solids discharge about 66 percent" (3).

We may now consider a second element of the Survey's assessment. This deals with several components of man's developments in the Upper Basin and how each is estimated to have individually contributed to the net effect on water yield and water quality at Lee Ferry.

Table II, as shown in the next slide, contains the Survey's appraisal in this respect, based on the assumption that each component could have been accomplished separately and in the sequence listed.

Evaporation from reservoirs and canals is estimated to have decreased average yearly water yield by about 200,000 acre-feet, increased average yearly concentration about 4 ppm, and has not changed dissolved-solids discharge.

Diversions of water from the Basin are estimated to have decreased average yearly water yield by about 465,800 acre-feet, increased average yearly concentration about 6 ppm, and decreased average dissolved-solids discharge by about 37,500 tons.

Domestic and industrial uses are estimated to have decreased average yearly water yield by about 22,600 acre-feet, increased average yearly dissolved-solids concentration by 2 ppm, and increased dissolved-solids discharge by 33,600 tons.

Irrigation, owing to consumptive use only, is estimated to have decreased average yearly yield by about 1.8 million acre-feet, increased average yearly concentration by 37 ppm, and has not changed dissolved-solids discharge.

Irrigation, due to leaching of the watered lands, is estimated to have had no effect on water yield, to have increased average yearly concentration by 199 ppm, and to have increased average dissolved-solids discharge by about 3.5 million tons per year. ("Leaching" is used in a very broad sense by the Survey to include all physical and chemical processes by which water, flowing or percolating, picks up dissolved solids from soil.)

The essential point to be considered in connection with this analysis is that, considering the Upper Basin as a whole, although a number of factors are associated with salinity increases, natural sources of salinity and irrigation were contributing most of the dissolved solids to the Basin's waters.

No study of a similar nature has as yet been reported for the Lower Basin. However, the quality of water in this area is of serious concern. This is well illustrated in a report "Salinity Problems in the Lower Colorado River Area" (4), by the Colorado River Board of California, which states:

"It has long been recognized that the problem of water quality is inter-related with and equal in importance to the problem of water quantity in the planning and development of the water resources of a river basin. The problem of the chemical quality of the water is of particular significance in the Colorado River Basin because of the geographic and legal situation and because of the inability of the dependable water supply of the river to meet all existing and potential demands upon that supply. The main river is nearly 1,400 miles long and offers innumerable opportunities for the diversion and use of water and return of excess diversions and drainage which increase the mineral content of the flow of the stream."

The California Board report goes on to say"

"The lower river probably will become more saline in the future as upstream irrigation activities increase. Many authorized projects in the Upper Basin remain to be constructed, and many existing projects are not yet fully developed. Increased consumptive use of the waters of the Colorado River and its tributaries in the Upper Basin, particularly the relatively pure water of the headwater streams, will result in higher concentrations of mineral salts in the residual flow downstream. It has been estimated that under future conditions the total dissolved solids at Imperial Dam may be as much as 1,150 parts per million, or about a 50 percent increase over recent past conditions. The anticipated results will be a need for a greater quantity of water to irrigate the same unit of land in the lower river area. Because of the increase in mineral content, more water will be required for leaching purposes and to maintain favorable salt balance in the irrigated areas. This problem concerns water users throughout the basin, but especially those in the Lower Basin states. If the people of the basin states and the Congress are to act intelligently in planning further development of the river, they must have complete information on a number of very important questions relating to the quality of the water of the river system."

Certainly the increasing total dissolved-solids content of Colorado River Basin waters is a major problem of serious concern to many. We consider it highly essential that this water resource be protected against all types of pollutants which might affect the utilization of Basin waters.

Investigations should be made, not only of pollution sources and concentrations, but more importantly, to determine feasible measures for protecting water quality for all uses so as to permit maximum economic growth and development in the Colorado River Basin.

This reflects a philosophy basic to the Federal Water Pollution Control program, as well as one explicitly recommended by the 1960 National Conference on Water Pollution, stated as follows:

"That the Conference express its conviction that the goal of pollution abatement is to protect and enhance the capacity of the water resource to serve the widest possible range of human needs, and that this goal can be approached only by accepting the positive policy of keeping waters as clean as possible, as opposed to the negative policy of attempting to use the full capacity of water for waste assimilation" (5).

It is of the utmost importance that this Interstate Conference consider, in its proper perspective, the matter of water quality with respect to total dissolved solids insofar as this Basin is concerned. This is a problem which is Basinwide in scope and effect and should at this time constitute the principal matter of consideration by this Conference.

The Project is therefore continuing with the development of a major fact-finding investigation to identify specific sources contributing to increases in salinity, to investigate technically feasible methods of reducing and limiting salinity, and to evaluate the maximum net economic benefit which will accrue to the Basin as improved salinity conditions are attained.

I would like at this time to indicate some of the directions and approaches of this program and to invite your suggestions and comments. Our plan of study involves four major steps:

(1) Identification and characterization of major sources causing salinity increases. As previously mentioned, a variety of sources contribute to the observed salinity buildup in the river. These are as follows:

(a) Natural sources - such, as for example, springs and ground-water reservoirs discharging concentrated brines to the stream;

(b) waste discharges from municipalities and industries;

(c) return irrigation waters contributing a dissolved-solids load to the stream;

(d) consumptive uses, that is, water lost to the river system by means of municipal, industrial, and agricultural activities;

(e) water removed from the river system by trans-Basin diversions; and

(f) water losses due to evaporation from reservoirs and canals and evapotranspiration.

In studying specific areas, the particular sources of importance in that area must be determined, as well as the nature of the salinity buildup resulting. For example, it is important to know if increased salinity concentrations can be attributed to increased loadings or to a decrease in available water; whether the increases are fluctuating or essentially constant; and what types of salts predominate. All this will require extensive field data development, as well as assembly and evaluation of available existing information.

(2) The second element of our study will involve investigations of feasible measures by means of which salinity increases could be reduced. Here, several possibilities are suggested by the nature of the physical and geologic features associated with the study area. We may investigate ways and means to reduce or control the flow

of naturally-occurring brines; or how to reduce evaporation and evapo-transpiration losses. We may study water savings that can be effected through decreased seepage losses in water development structures or by increased efficiency of water use. We may look into possible alternative water uses and their effects on the water quality of the Basin. Other possibilities, of course, may also suggest themselves along the way.

(3) As our work progresses, we would project water quality conditions which would prevail with no salinity reduction measures in effect against those which might be expected with institution of the various salinity reduction measures. In this step we would consider not only the present situation, but also future conditions based on anticipated developments in the Basin.

(4) The fourth element of our study plan would determine the salinity levels at which net maximum economic benefits would accrue to the Basin. We would arrive at this by a synthesis of the studies outlined in step (2) above with studies of the net benefits accruing to the Basin as salinity is reduced. The objective of this is a determination of salinity levels which will support optimum development in the Basin as measured by maximum gross regional product, less cost of water.

This provides criteria of water quality associated with an objective of maximizing net economic benefits to the Basin. Other objectives requiring a higher level of water quality may take precedence over these criteria such as, for example, the protection of a water use associated with an overriding public want. By means of an analysis of this type, however, we will be in a position of being able to demonstrate the cost involved in satisfying such a want.

Some elements of the program I have outlined have already been initiated in a limited way. I want to emphasize that this study of salinity will now constitute the major effort of the Project. We are not, I would add, ignoring other types of pollutants and will also consider those as appropriate. But we do feel most strongly that, viewed in its proper perspective, the salinity problem must occupy the number one place in our work program.

A study of this type is urgently needed in the Colorado River Basin. The limited supply of water available is daily being committed to particular uses, and protection of water quality assumes a greater significance as pressures upon the available supply increase. This endeavor will ultimately benefit all water users in the Basin in line with the stand taken by the Senate Select Committee on National Water Resources, which states:

"... The concept of comprehensive development should be redefined to include all purposes served by water resources and all measures available for meeting prospective demands, including the preservation and improvement of water quality, instead of limiting this definition to the mere volumetric management of surface water resources, which has generally gone under the term of 'comprehensive development' in the past. As already noted, by 1980 some of the western regions must depend upon full utilization of their water resources to support anticipated growth. This means there will be an urgent need for improved efficiency of water use, for salvage and reuse of waste water, and for artificial increases in supplies if all demands are to be met" (6).

I am sure you will realize that we have launched a most ambitious and difficult undertaking. In order to carry it forward to a successful conclusion we will welcome, and certainly must depend heavily upon, the assistance and cooperation of Federal, State, and local agencies, and private groups, as well.

That concludes my statement.

TABLE I

WATER YIELD AND WATER QUALITY OF COLORADO RIVER AT LEE FERRY, ARIZONA*

Comparison of Situation as of 1957 with "Hypothetical Virgin Situation"

	Average Water Yield Acre-Feet per Year	Average Yearly Dissolved Solids Concentration-ppm	Averaged Dissolved Solids Discharge-Tons Per Year
Hypothetical Virgin Situation	15,190,000	253	5,229,900
Situation as of 1957	12,733,000	501	8,676,000

*From Department of Interior Progress Report "Quality of Water, Upper Colorado River Basin," January 1963, Part I, page 2.

TABLE II

WATER YIELD AND WATER QUALITY OF COLORADO RIVER AT LEE FERRY, ARIZONA*

Estimated Effects of Individual Components of Man's Developments in Upper Basin as of 1957

	Change in Average Water Yield-Acre-feet per year	Change in Average Yearly Dissolved Solids Concentration-ppm	Change in Average Dissolved Solids Discharge - tons per year
Evaporation from Reservoirs and Canals	-200,000	+4	--
Diversions of Water out of the Basin	-465,800	+6	-37,500
Domestic and Industrial Uses	- 22,600	+2	+33,600
Irrigation-Consumptive Use	1,769,000	+37	--
Irrigation-Leaching of Watered Lands	--	+199	+3,450,000

*From Department of Interior Progress Report "Quality of Water, Upper Colorado River Basin," January 1963, Part I, page 2.

NOTE: Minus sign indicates decrease, plus sign indicates increase.

Bibliography

(1) Quality of Water, Upper Colorado River Basin Progress Report, U. S. Department of the Interior January 1963

(2) Ibid., Part I, p. 1

(3) Ibid., Part I, p. 2

(4) Salinity Problems in the Lower Colorado River Area, Colorado River Board of California, State of California, September 1962. p. 7

(5) Proceedings, The National Conference on Water Pollution, p. 564. U. S. Government Printing Office, 1961

(6) Report of the Select Committee on National Water Resources, 87th Congress, 1st Session, Report No. 29, p. 45. U. S. Government Printing Office, 1961

MR. STEIN: Thank you, Mr. Sponagle. Are there any comments or questions?

MR. BONDERSON: Mr. Chairman, I don't have any questions at this time, but we could come back and discuss this? Is that right?

MR. STEIN: Oh, yes. All matters will be available for discussion, and the people who have made presentations and others will be available to answer any specific questions.

MR. BONDERSON: Thank you.

MR. STEIN: Off the record.

(Discussion off the record.)

MR. STEIN: At this point we will stand in recess until 2:00 o'clock.

(Whereupon, at 11:42 a.m., the conference was recessed until 2:00 p.m. of the same day.)

AFTERNOON SESSION

MR. STEIN: May we reconvene. Mr. Klashman.

MR. KLASHMAN: We are now going to hear from the other Federal agencies. The first person on whom we will call is the Department of Agriculture, Mr. Clyde Stewart.

STATEMENT OF
CLYDE E. STEWART
WESTERN BASIN PROGRAMS
ECONOMIC RESEARCH SERVICE
UNITED STATES DEPARTMENT OF AGRICULTURE
LOGAN, UTAH

MR. STEWART: Thank you, Mr. Chairman. I am Clyde Stewart of the Economic Research Service of the United States Department of Agriculture, with headquarters at Logan, Utah. I will make a few comments about the economic base study that Mr. Fitzpatrick referred to this morning.

This study is a three-way cooperation by several Rocky Mountain universities, the Economic Research Service, and the United States Public Health Service. The immediate objective is to develop an economic framework that can serve as the basis for comprehensive planning with respect to water quality. But this study should also contribute to land and water resources development generally.

With respect to the economics of land and water resources development, this economic base study is comprehensive in terms of present and potential alternative uses to the extent that these uses can be described and estimated.

As stated in Document 97, the basic objective in the formulation of plans is to "provide the best use or combination of uses of water and related land resources to meet foreseeable short- and long-term needs."

Quoting further: "Programs and projects shall be formulated as part of the comprehensive plan of a river basin or other area. Economic projections will be made to provide a basis for appraisal of conditions to be expected with and without the plans."

You will recall that this document lists eleven types of primary benefits, including irrigation, water quality control, and recreation. This research is being done on the basis of subbasins, six in total, and eventually for the total Colorado River Basin.

As noted this morning, this past year efforts have been directed to the Green Subbasin. The approach being applied is an inter-industry input and output analysis. This inter-industry technique was developed originally for analyzing the structural independence of individual sectors of the national economy.

We are currently applying this technique to a small area economy, the Green Subbasin, and will later apply the technique to the total Colorado River Basin.

The first step has been to develop an input-output table or model showing interrelationships and economic activity for 1960 for the subbasin. Subsequently we will develop similar projected economies. We have set up thirty-four sectors or industries, which I will not list; but, as examples, agriculture, oil and gas, coal, uranium, retail trades of various kinds, transportation, local government, and so forth.

For study purposes, the Economic Research Service is concerned directly with the agricultural and forestry aspects of the economy. Projections of these agricultural industries will be made within a framework of prospective national growth and national demand for agricultural products and the available basic resources within the Basin.

Alternative projected growth patterns of agriculture in the subbasins and Basin for a fifty-year period will be estimated within this framework.

In effect, two major projections are made. The first is a consideration of prospective and potential agricultural production without new water developments, adjusting for technologies, changes in farm sizes, conservation measures, more efficient use of water and other resources, and other factors.

Then, new water developments and uses -- for example, those under construction or authorized or likely -- are added at various stages of the time-table.

As a somewhat major third step, several questions are then asked, including (1) what are the water quantity restraints on these agricultural paths? (2) what are the water quality restraints under various stages and kinds of economic growth? and (3) what institutional factors condition adjustments in the use of water?

In preparing a comprehensive water pollution control plan for a river basin, it is necessary to ascertain the present and future water requirements for each urban and industrial center, each farming and irrigation area, each power development, each fishing and recreational area, for irrigation and for all other water uses. The water quality requirements for each such use must also be determined. I am sure some of you will recognize these as quotations from one of the Senate Select Committee prints.

The inter-industry input-output model or economic base study is one means of procedure for accomplishing these purposes or for providing the analytical framework for their accomplishment, since it does recognize all industries and all uses of water and permits recognition of quality and quantity restraints on kinds and locations of economic development.

The greatest argument in favor of this procedure apparently rests in the fact that it considers interactions among various industries and activities are stated differently, and that it measures and emphasizes the secondary effects or benefits or costs of each particular activity. For example, a dollar invested in agriculture may stimulate several dollars of activity throughout a local economy. These effects are reflected in the input-output table or analysis.

In summary, the purpose of an economic base study is to provide an analysis of the economic characteristics, developments, and trends of the past, and a projection of future growth and needs of the area.

In spite of its limitations, the base survey should provide estimates of economic activity in the Basin that will be basic to the development of a useful water quality and a quantity management program.

Thank you very much.

MR. STEIN: Thank you, sir. Are there any questions or comments? Mr. Klashman.

MR. KLASHMAN: Mr. Davoren of the Department of the Interior will now introduce the speakers for the Department of the Interior.

INTRODUCTION BY
WILLIAM T. DAVOREN
REGIONAL COORDINATOR
UNITED STATES DEPARTMENT OF THE INTERIOR
SALT LAKE CITY, UTAH

MR. DAVOREN: Thank you, Mr. Klashman: Ladies and Gentlemen -- or rather, I should say, Gentlemen and two ladies, I think it is: I am awfully glad to be here. I will introduce to you the representatives of the various Bureaus of the Department of the Interior and, following that, a statement will be presented by Mr. Maurice Langley.

From Geological Survey -- gentlemen, if you will stand as I call your names, if you don't mind -- Mr. Burdge Irelan from Yuma;

Mr. Charles McDonald from Yuma;
and Mr. Art Piper from Menlo Park.

The Bureau of Reclamation: Cecil B. Jacobson from Salt Lake City;

Jack Rodner from Boulder City.

The Bureau of Mines: Dick Maurer, Regional Director from San Francisco.

The Bureau of Outdoor Recreation: Mr. Ernest Allen from Denver;

Mr. Floyd Henderson from the San Francisco Regional Office.

From the Office of Saline Water, which has a very well-known plant right here in San Diego, the engineer in charge is with us today, Mr. Stewart Mulford.

Now I would like to present to you Mr. Maurice Langley of Washington, who will present our Departmental statement for this meeting. Thank you.

STATEMENT OF
MAURICE LANGLEY
ASSISTANT CHIEF
DIVISION OF IRRIGATION AND LAND USE
BUREAU OF RECLAMATION
UNITED STATES DEPARTMENT OF THE INTERIOR
WASHINGTON, D. C.

MR. LANGLEY: Thank you, Mr. Chairman. Ladies and Gentlemen: I think there is a ray of hope. I notice that this Colorado River water which has been imported probbably through the Metropolitan Aqueduct and the San Diego Aqueduct has been pushed upon you closer and closer on the table. Nobody seems to be drinking it after this morning's papers. But with the assistance of the saline water plant, we can arrange to get you some de-salinized water, if you wish.

As a representative of both the Department of the Interior and the Bureau of Reclamation, I have been asked to convey the best wishes of the Secretary of the Interior, Stewart Udall, and the Commissioner of Reclamation, Floyd E. Dominy, to all of you and to wish this conference every success.

The broad interest of the Department of the Interior in the water and related problems of the Colorado River system is reflected in the Department's representation at this important conference.

Observers present include representatives of the Geological Survey, the Office of Saline Water, Bureau of Reclamation, the Bureau of Mines, and the Bureau of Outdoor Recreation, as you have just heard introduced.

Each of these agencies has a direct concern with aspects of water quality. Each has programs in this broad field. Some of the programs are recent, such as that of the Bureau of Outdoor Recreation. Some Interior agencies have come into existence in the past ten years, such as the Office of Saline Water. Some began work on this subject twenty-five or more years ago, such as Fish and Wildlife Service. Others go back into history many years, such as the programs of Geological Survey, Bureau of Mines, and Bureau of Reclamation.

Over the past eighty years Congress has provided various authorities to Interior agencies and charged them with the responsibilities for various actions in the water quality field. A statement concerning these authorities and the nature of the work in the Pacific Southwest Region is recorded in the Department statement prepared recently for the internal use of the Water Quality Technical Subcommittee of the Pacific Southwest Inter-Agency Committee.

The Department is pleased to observe that this new Federal-State technical subcommittee was formed during the period that the Departmental representative was chairman of the Pacific Southwest Inter-Agency Committee.

Water and the problems and opportunities it carries ignores state, regional, and even international boundaries. It is important that the interrelationships of water use be recognized; and that state, Federal, and local government agencies charged with various aspects of water management and development work harmoniously in solving these many problems.

The Department of the Interior, and the many agencies in it dealing with water problems, remains ready to fulfill its responsibilities to the states and to the nation. We welcome this opportunity to continue work with the Department of Health, Education,

and Welfare, with its Public Health Service, and other state and Federal agencies dealing with the problems of pollution of the Colorado River.

A second item, Mr. Chairman -- if this is the appropriate time -- is I think the record should be clarified perhaps in regard to the City of Yuma diversion.

Is this the right time to do it?

MR. STEIN: Go right ahead, sir.

MR. LANGLEY: With the increasing water development on the Lower Colorado River following World War II, there were a good deal of discussions held with the City of Yuma in regard to what would naturally take place in regard to its water supply.

The city was also growing at a rate that it was obvious that, at the peak demand season in the summer, its old Blaisdell filing would no longer take care of its needs. Various proposals were considered on how to handle the future water needs of the City of Yuma.

There were suggestions of handling its water through the Gila Project system so that it would have a desilted supply diverted upstream. The same considerations were given to possible deliveries through the All-American Canal system.

After lengthy discussions, with which I am quite familiar -- I was Chief of Operations on the Lower Colorado River at that time -- a joint letter was written to the Bureau of Reclamation on June 14, 1957, by the then mayor of the City of Yuma, and the vice president and general manager of the Arizona Water Company.

That letter specifically requested that, rather than take its water through either the Gila system or the All-American, they preferred to contract for delivery of water directly in the river upstream.

In accordance with their own specific request, a contract was negotiated and executed on 15 November 1959 which makes provision for the city's new point of diversion, being delivered "to the City at a point in the Colorado River immediately below the downstream edge of the California sluiceway at Imperial Dam, and within the limitations as to rate of delivery hereinafter provided, such quantity of water" and so on, which combined their old Blaisdell filing and their new quantities for a total not to exceed 50,000 acre-feet annually.

I don't believe this can be totally ignored when we talk about the City of Yuma's water supply. Thank you.

MR. STEIN: Thank you, sir. Are there any questions or comments? Mr. Klashman.

MR. KLASHMAN: Does that finish your presentation, Mr. Davoren?

MR. DAVOREN: Yes, sir.

MR. KLASHMAN: We will now hear from the Atomic Energy Commission, Mr. Donald Nussbaumer.

STATEMENT OF
DONALD A. NUSSBAUMER
CHIEF, SOURCE & SPECIAL NUCLEAR MATERIAL BRANCH
DIVISION OF LICENSING REGULATIONS
UNITED STATES ATOMIC ENERGY COMMISSION
WASHINGTON, D. C.

MR. NUSSBAUMER: My name is Donald Nussbaumer and I am with the Division of Licensing and Regulation of the Atomic Energy Commission in Washington, D. C.

We certainly appreciate the opportunity of attending the fourth session of the Conference on the Pollution of the Colorado River and its Tributaries.

At the previous three sessions of the Conference, the Atomic Energy Commission described its regulatory program with respect to uranium mills, the terms and conditions of authorizations granted to uranium mills concerning the release of liquid effluents, and its plans for dealing with two matters which had been discussed previously at these conferences, namely, a means for receiving prompt notification of failures in embankment retention systems, and the development of criteria for the construction and maintenance of embankment retention systems.

In June of 1962 the AEC proposed to each licensed uranium mill a license condition which would require immediate notification to AEC of any failure in an embankment retention system which resulted in the release of radioactive material into unrestricted areas.

All of the uranium mills accepted this condition, and their licenses have been amended accordingly.

Upon the receipt of such notification, the AEC will promptly notify the appropriate state officials.

Since the last session of this conference, the AEC, in conjunction with the Division of Water Supply and Pollution Control of the Public Health Service, has prepared a licensing guide dealing with the construction and maintenance of embankment retention systems. This guide has been circulated for comments to each state in which uranium mills are located and to the uranium mills. Comments were due on May 1, 1963.

The comments received are being carefully considered in preparing a final version of this guide. The criteria expressed in the guide will be used in connection with the evaluation of applications for licenses and license renewals where embankment retention systems are employed.

We believe that the application of these criteria will go a long way toward assuring that embankment retention systems are constructed and maintained in accordance with sound engineering principles.

Once again the Atomic Energy Commission desires to work closely with interested Federal and state agencies in matters which relate to our regulatory responsibility. We would like also to express our appreciation to the interested Federal and state agencies for the cooperation and assistance they have given us.

Thank you.

MR. STEIN: Thank you. Are there any questions or comments?

MR. KLASHMAN: Mr. Nussbaumer, did you want anyone else from AEC to make a statement?

MR. NUSSBAUMER: I don't know whether Mr. Schoen wants to make a statement or not. I guess he does.

STATEMENT OF
ARTHUR SCHOEN, HEALTH PHYSICIST
DIVISION OF OPERATIONAL SAFETY
UNITED STATES ATOMIC ENERGY COMMISSION
WASHINGTON, D. C.

MR. SCHOEN: Good afternoon. I would like to add my appreciation to that already extended by Mr. Nussbaumer for the opportunity of appearing before this group.

My remarks this afternoon are confined to the Monticello Mill, which -- as the people here know -- is the best-known mill, which has not been operated since December of 1959.

During its operation, approximately one million tons of tailings have been accumulated on the property at the Monticello site. These tailings were stored in several piles located and constructed in a manner to permit the clarification of the liquid portion for re-use in the mill circuits, and to control the necessary bleed-off of clarified wastes into South Creek.

South Creek is a very small natural water course which, for most of the year, consists primarily of the outflow of a sewage plant serving the town of Monticello. It flows across the millsite, between the tailings piles, and across adjacent private property to join Montezuma Creek. South Creek water is not fit for human consumption, but has been used to a limited extent for irrigation of forage crops and for watering livestock.

Regular maintenance work during the period of active operation of the mill had kept the tailings secure against wind erosion. With the cessation of operations, however, the surface of the piles dried out and became subject to movement by wind action. There was a tendency to form moving sand dunes.

The possibility that the transport of the tailings onto adjacent private property might become a public nuisance, especially in view of the proximity of the town, and the use of nearby land for forage crops, led to a decision to grade the piles in order to promote drainage, and to stabilize them with a heavy rock and soil cover.

As an added insurance, the soil cover was seeded in the belief that vegatation would add some protection against erosion. The grading work was started in the summer of 1961, but was not completed until July 1962.

In the early part of 1962 Public Health Service representatives called attention to some radium concentrations in South Creek bottom sediments which were believed to be attributable to inadvertent scattering of tailings into the stream during the grading operations. Subsequently, monitoring of South Creek has been carried out by analyzing the radium content of the water and suspended solids of samples taken both upstream and downstream from the millsite. The record of the analyses to date is shown in the attached table.

The concentration of dissolved radium at the downstream location is generally higher than upstream. The difference between the two samples was substantial during periods when work on the tailings was in progress; but, since the completion of this work, it has decreased markedly. Currently the downstream concentration is consistently below the limit specified in Title 10 CFR Part 20 for release of radium to unrestricted areas.

The radium content of the suspended solids at the downstream location is highly variable and does not correlate with tailings disturbance nor with the dissolved radium concentrations. In any event, the maximum value reported for suspended radium is less than one percent of the Title 10 CFR Part 20 limit for insoluble radium concentrations in effluents discharged into unrestricted areas.

Radium Content of South Creek Water Samples, Monticello, Utah

	Dissolved ucRa-226 x 10^{-8} per ml		Suspended ucRa-226 x 10^{-8} per ml	
	Upstream	Downstream	Upstream	Downstream
January 1962	NS	0.13	NS	0.15
February *	0.06	2.40	NS	NS
March 14 *	0.04	2.80	0.36	9.97
March 23 *	0.09	1.20	0.07	14.60
April 6	0.26	0.90	1.40	13.10
May 3	0.16	0.24	0.29	0.67
May 29 *	0.05	1.84	0.64	0.30
June (no samples)	--	--	--	--
July 6 *	0.08	1.49	0.12	0.14
August 1	0.03	0.88	0.04	0.12
August 14	0.02	0.89	0.04	0.36
September 24	0.03	0.58	0.13	0.07
October 24	0.03	0.56	0.04	0.08
November 14	0.02	0.18	0.18	0.62
December 18	0.02	0.13	0.05	0.15
January (no samples)	--	--	--	--
February (no samples)	--	--	--	--
March 21, 1963	less than 0.01	0.19	0.03	0.18

* Grading of tailings and riprapping stream banks was going on at the millsite.
All samples were grab samples. Radium analyses were made by GJO Laboratory using Idaho Falls carrier precipitation method. Flow data is not available
Title 10 CFR Part 20 limit for dissolved Ra-226 is 1 x 10^{-8} uc per ml.
Title 10 CFR Part 20 limit for insoluble Ra-226 is 3 x 10^{-8} uc per ml.

MR. STEIN: Thank you, Mr. Schoen. Are there any comments or questions?

Mr. Klashman.

MR. KLASHMAN: Are there any other Federal agencies who wish to make a statement at this time? If not, that completes our presentation, Mr. Stein, for the Federal agencies.

MR. STEIN: Thank you, Mr. Klashman. We will now call on the states. Wyoming, Mr. Williamson.

STATEMENT OF
ARTHUR E. WILLIAMSON
DIRECTOR OF ENVIRONMENTAL SANITATION
WYOMING DEPARTMENT OF PUBLIC HEALTH
CHEYENNE, WYOMING

MR. WILLIAMSON: Thank you, Mr. Stein. We have an overall statement, but probably not too many comments on what is happening in our state. However, I would like to make one or two comments in regard to the study.

Going back to Mr. Sponagle's paper, I was interested in his four points, one in particular with regard to this economic analysis. I believe the title is, "The Mininum Economic Benefit Study."

All I can say, Charlie, is I hope you can come up with a criterion for the actual value of an acre-foot of water whenever it is used in one process or another -- the value; not what it costs, but what is the value of an acre of water which runs through a turbine under conditions where it is used for irrigation, or if it is used for an industry or something of this type.

Then we would have a way of evaluating what the water is worth. Then we could see that some of these uses are probably not adding everything they should to their overall economic value. This is one I have kicked around for a number of years before we got a very rough criterion out of the thing. I am surprised at the figures that we have come up with to justify a good sound economic basis.

I would mention this salinity problem. I think it is one we have to study, and I certainly am glad to see we have accumulated this much information in pinpointing the sources. Certainly our next problem is to evaluate these as to actual damage which each of them is doing and what might be done for elimination of such.

I think the time is probably fast approaching when this double standard idea has to be settled. Chlorides and sulfates are real big trouble when they are put into the river by an industry. We jump all over them and we take them take them out. The same way with turbidity.

I have faced this problem in our own state. Anybody putting dirt in the stream, we have made them take it out. We have had quite a few good hassles with industry over the turbidity they have added to the stream. But we have won so far.

We were put in a rather bad spot because at the same time a Government installation was flushing tons and tons and tons of dirt down the stream, and they would always point the finger at this. This is our old double standard again. Some day we have to decide if it is good for one person or if it is good for everybody, and agree on it, I think. Otherwise we will always have conflucts in this field. Chloride or sulfate is still the same, regardless of where it comes from. It can be controlled and it must be controlled.

That is all I have to say.

MR. STEIN: Thank you. Are there any comments or questions? If not, I certainly agree with you, Mr. Williamson.

As you may know, last week we appeared before the House Committee on Government Operations. We were up there particularly with respect to Government installations.

As far as I can tell from the Committee's point of view, and certainly from ours, a Government installation is no different from any other.

As a matter of fact, the President has indicated that the Government installations and Government projects are to take the lead in pollution abatement. As many of you know, this is a bi-partisan operation, because the inventory which we started on Government installations was inaugurated under President Eisenhower's administration, and has certainly been carried forward under the present administration.

As you know, most of the provisions in the bills had bi-partisan support. As a matter of fact, the original bill in 1948 was sponsored by then Senator Taft and Senator Barkeley. Except for certain provisions, they have had complete bi-partisan support, particularly the ones in Federal installations. We would agree that they have to be cleaned up with the others and, as a matter of fact, show the way and take the lead.

As you well know, we have been up in your state with an agricultural industry dealing with agricultural products which put a good deal of silt and turbidity in the stream. We were pretty adament, and they are installing remedial measures.

I don't think that any Federal agency charged with enforcing the law can do this except in an even-handed way, expecting all to comply -- and not the least of these Federally-sponsored operations.

I would suggest, Mr. Williamson, and anyone else, if you have industry representatives from your states here, you may wish to call on them to proceed.

There is one more remark. I think we thoroughly agree on this, and I want to make this clear. We agree with you on the importance of the economic survey. We are expending all efforts to do this.

(Discussion off the record.)

MR. STEIN: Mr. Thatcher.

STATEMENT OF
LYNN M. THATCHER, EXECUTIVE SECRETARY
UTAH WATER POLLUTION CONTROL BOARD
SALT LAKE CITY, UTAH

MR. THATCHER: I don't have a specific report, but I have a couple of comments and questions. Again, as before, I would like to express appreciation to the Public Health Service for the help which they are giving us in this program, which obviously the states couldn't do alone.

I feel now that progress is very good. I think prior to the last session there was still a little tooling up on the part of the service.

Now it seems to me that we are really in high gear and making real progress. We hope this will continue along present lines, including investigation into the water quality criteria that we talked about at Santa Fe, New Mexico.

I also would like to make a plea for the continuation of the interim technical meetings, if this is in the cards. I think this was very beneficial for the group as a whole.

I recall that, at Santa Fe, the question on existing water quality data was raised, and the statement was made about the possibility of obtaining some of this, particularly from some of the other Federal agencies. I wanted to ask if any progress along this line has been made.

MR. STEIN: Would you care to answer that, Mr. Klashman?

MR. THATCHER: This is a collection of existing water quality data from other Federal agencies.

MR. KLASHMAN: We are in the process now, as Mr. Stein mentioned, of carrying out a program of upgrading water pollution control practices in all Federal agencies. This has not so far included any of the Bureau of Reclamation projects, but it has all others. We are currently working with all the agencies on this.

On the collection of water quality data, we are working very closely with the U. S. Geological Survey. The Bureau has been very helpful in furnishing anything at all that they can give us that is available.

Does that answer your question?

MR. THATCHER: The only point that I had was, we would be interested in the states eventually getting into this. There was a question as to whether or not the states ought to request it directly.

We felt it would be better to let you people obtain it for us. Eventually we would like to get whatever is available. I don't know how much is available.

MR. KLASHMAN: What we have collected, we will get to you. I misunderstood you. Mr. Sponagle will be in touch with you, Mr. Thatcher, and see that you have what data we do have.

MR. THATCHER: Thank you.

MR. STEIN: Thank you, Mr. Thatcher. We will, I expect, continue these technical meetings, which have been very, very helpful to us. Again, I think everyone should realize that a project of this kind, involving this many states and this big an area of the country for all concerned, I think, was a pioneering effort.

For several years we had to feel our way and kind of tool up. I think one of the best suggestions which has proved most fruitful has been the suggestion from the state representatives here that, prior to going into a conference of this type, we have a technical meeting where we can discuss and formulate the technical direction so that the progress at these meetings can be more meaningful.

I think the character of our reports this morning has evidenced that. This is in no small measure due to the fact that prior consultation and technical meetings were had with the state representatives.

I do not think, as experience shows, that before have we had such meaningful documents moving us ahead with such little controversy. We certainly will continue that, and we are very grateful to the state representatives for suggesting that, because the notion of this technique came from the states. It has proved useful in other areas, and I am sure it will continue to do so.

MR. THATCHER: Should I call on some of our representatives?

MR. STEIN: Yes, sir.

MR. THATCHER: I had expected that some of our other state agencies would be represented. I don't recognize any of them. Just so I don't miss anyone, is Dr. Sigler of the Utah Water Pollution and Control Board here?

MR. KLASHMAN: Mr. Thatcher, Dr. Sigler has telephoned saying he couldn't come.

MR. THATCHER: Is Mr. Chamberlain of the Utah Fish and Game Department here, or anyone else from the Utah Fish and Game Department?

Or Mr. J. Bingham of the Utah Water and Power Board, or anyone else from that agency?

Apparently these people didn't make it. I know that Mayor Boyd of Moab is here, and I believe he is the only invitee of the official city representatives whom we invited.

Would you care to make a statement, Mayor Boyd?

MR. BOYD: I would like for my engineer, Mr. Holder, to make a statement, sir, if it is all right. This is Davis Holder, Sanitary Engineer for the City of Moab.

STATEMENT OF
DAVIS C. HOLDER, ENGINEERING CONSULTANT
CITY OF MOAB, UTAH
GRAND JUNCTION, COLORADO

MR. HOLDER: Chairman Stein, Conferees: I want to thank you for the opportunity of presenting a statement, although I do not have a prepared statement.

Several very interesting points have been discussed today, one by implication only, I think. Chairman Stein mentioned the possibility of using some existing and perhaps to be abandoned dams on the Uncompahgre. This brings to mind that this is something of a sore subject with us in our area.

Many small reclamation projects have been investigated and found to be completely not feasible -- the principal reason, of course, being that real dollar benefits must be returnable to the United States Treasury.

Many of these projects bear a cost-benefit ratio of .89 to 1, .95 to 1 -- quite close to being economically feasible. If through the action of this body a dollar-and-cents value can be placed on decontamination, sedimentation, in short, general cleaning up of the main stem through the control of tributaries, many of these projects would become feasible.

Mayor Boyd, I am sure, is aware of the fact that I am referring specifically to the Back Creek project, which is of interest to the City of Moab and its surrounding community.

The other point which comes to my mind is the splendid cooperation which has been obtained from industry in the cleaning up of this uranium and radium problem. In many cases the cleaning up has been done despite the fact that a price schedule was originated and instigated prior to the knowledge that there was even a problem. In other words, industry has more or less footed the bill for this.

By the same token, we are also aware that we are perhaps only delaying the ultimate solution. We are concentrating uranium wastes and other radioactive materials, and sooner or later we have to look at the ugly problem of this ultimate removal that was mentioned.

In all fairness to industry it strikes me that -- again perhaps through the instigation of this body -- research could be done into the streamlining of processes, the recycling processes, and so forth; in other words, greater usage of these materials, and therefore reduction of the wastes.

This could be done on a basis which would be profitable to the industrial people. And, not to be cynical but to face an obvious fact, industry's cooperation would be even greater if it could be shown to be profitable to them rather than costly.

Beyond this, I have no particular comments. I thank you for your time.

MR. STEIN: Thank you very much.

MR. THATCHER: We have some industry representatives here. Mr. June Crawford of Texas Gulf Sulphur Company is here. Would you care to make a statement?

STATEMENT OF
JUNE W. CRAWFORD, CHIEF ENGINEER
TEXAS GULF SULPHUR COMPANY
MOAB, UTAH

MR. CRAWFORD: My name is June Crawford with the Texas Gulf Sulphur Company in Moab, Utah. I have been asked to read this brief statement by our general manager, Mr. F. E. Tippie.

Gentlemen: The Texas Gulf Sulphur Company, Inc., expects to start up their potash mine and plant shortly after mid-year. The mine and plant are located on the north bank of the Colorado River, approximately thirteen miles downstream from Moab, Utah.

The waste from the plant will consist of predominately sodium chloride and with minor quantities of calcium sulphate. The waste product will be pumped into a large waste storage area located about one mile behind a 100 percent compacted earth core dam.

The dam is located more than one-half mile from the Colorado River. Water used in transporting the waste product will be in closed circuit between the tailings treatment building, the waste storage area, and the water storage area behind the dam. There will be no effluent to the Colorado River.

The brine used in processing is saturated with potassium and sodium chlorides. It will be in closed circuit within the plant.

The only material from the plant returned to the Colorado River is the treated, clarified and chlorinated effluent from our sewage plant. This amounts to approximately 10 gallons per minute.

A topographic model has been prepared showing the plant and its various facilities, and will be available shortly in Salt Lake City. We hope to arrange a meeting to show this model and to explain our waste disposal technique to all interested Federal, state, and local authorities.

If those of you who are interested will inform us by writing to our Moab, Utah, office, we will advise you of the time and place of this meeting in Salt Lake City, and we will also be pleased to arrange for interested parties to visit the plantsite.

Very truly yours,

F. E. Tippie

MR. STEIN: Thank you, sir. Are there any comments or questions? I would like to go back to Mr. Holder for a moment.

(Discussion off the record.)

MR. STEIN: Mr. Thatcher.

MR. THATCHER: Mr. Travis H. Redman is here representing Texas Minerals Corporation. Would you care to make a statement, Mr. Redman?

STATEMENT OF
TRAVIS H. REDMAN
ASSISTANT TO THE PRESIDENT
TEXAS-ZINC MINERALS CORPORATION
GRAND JUNCTION, COLORADO

MR. REDMAN: I don't have a prepared statement. I did want to take this opportunity of thanking Mr. Thatcher for being so kind as to allow us to appear and to be here.

We operate a uranium mill processing plant at Mexican Hat in the State of Utah on the San Juan. We use quite a bit of water. In the past six or seven years we have had our share of problems complying with regulations and reducing the amount of effluent and these other matters.

The biggest problem we are going to have this year, I believe, is possibly the dearth of water to operate with. The local people tell us we can expect the San Juan to get pretty low this year.

With Dr. Tsivoglou's permission, I would like to correct a misunderstanding he might have had. We did not have a dam break at Mexican Hat. We didn't use big enough nails in our pile. We had a few hundred tons go down the down-board side of the tailings pipe.

That is all I had to say.

MR. STEIN: Thank you, Mr. Redman. Any comments or questions?

Mr. Thatcher.

MR. THATCHER: Mr. T. F. Izzo of the Uranium Reduction Company of Moab is here. He said earlier he didn't think he would have a statement to make. Just in case he has thought of something, I would like to give him an opportunity, if he cares to take advantage of it.

MR. IZZO: The Uranium Reduction Company is now the Atlas Minerals Division of Atlas Corporation. We have no statement at this time.

MR. THATCHER: Thank you for the correction. Are there any others here of Utah's invitees, either from the cities or counties, and the industries, whom I haven't recognized? I want to make sure that every one has an opportunity to make a statement.

I believe that finishes my contribution.

MR. STEIN: Thank you, Mr. Thatcher.

Mr. Shaw.

STATEMENT OF
GEORGE E. SHAW
PUBLIC HEALTH ENGINEER
BUREAU OF ENVIRONMENTAL HEALTH
NEVADA STATE DEPARTMENT OF HEALTH
RENO, NEVADA

MR. SHAW: I know Wally White, if he were here, would be real pleased to see the way in which these papers have been presented. I know that they were very comprehensive and inclusive.

I hope that the economic study which you are about to undertake will bear as many fruits from your labors as the other efforts in this particular area. I do hope that the states can cooperate in helping to try to find a solution to this salinity problem.

I think Wally White does hope that you do continue your routine sediment analysis on the Lake Mead sediments. I know that is one of our major interests in southern Nevada.

I don't think there are any other representatives from Nevada here. Is there someone who would like to make a statement at this time? Mr. Rodner?

MR. RODNER: I just live in Nevada.

MR. STEIN: Any questions or comments? I do think that once we get started a bit on our economic survey -- in fact, we don't quite have the contracts all signed yet -- we hope to get these people possibly in a meeting with the state representatives in a technical meeting.

So perhaps we may be able to get the same kind of guidance and advice from you in the economic survey, and you can get the notion of what the committees are going toward as we have in the other aspects of the program. I think that might be very helpful.

We go to California. Mr. Bonderson.

STATEMENT OF
PAUL R. BONDERSON, EXECUTIVE OFFICER
STATE WATER POLLUTION CONTROL BOARD
SACRAMENTO, CALIFORNIA

MR. BONDERSON: Mr. Chairman, Conferees, Ladies and Gentlemen: California does have a statement they would like to present, which I have copies of here.

The State of California presented a formal statement to the Conference on Interstate Pollution of the Colorado River at its first session held in Phoenix in January of 1960. This statement explained the State's interest and concern as to the quality of the waters of the Colorado, and urged that a cooperative water quality study of the Colorado River Basin be initiated.

No formal presentations were made at the next two Conference sessions. However, at the second session, California representatives commented on four points that should receive the attention of the Conferees.

Three of these points were listed in the summary at the second session, and they were:

First, that the long-range aspects of radioactive waste disposal be given appropriate weight and emphasis in the Colorado River Basin water quality control project;

Second, that invitations be extended to all industries in the Basin who are interested in water quality to participate in future sessions of the Conference, and that such industries be solicited for reports on what actions they are taking relative to water quality; and

Third, that the raw and analyzed data being accumulated by the Public Health Service on all aspects of the water quality control project be furnished to the state agencies on a regular basis.

The fourth point relating to the need for establishing water quality criteria or standards to be used in a water quality management plan for the Basin was not included in the summary.

It might be well to reiterate California's position in this matter and to elaborate on the comments made at the second session.

As an outcome of the earlier Conference sessions, one of the several projects which the U. S. Public Health Service has initiated upon the recommendation of the Conferees is the formulation of a long-term water quality management plan for the entire Basin.

It is our opinion that one of the first steps in the formulation of this plan is the definition of the policies and principles to be followed in developing the water quality objectives to be used in determining what will or will not constitute pollution of the Colorado River waters. It is for this reason that we urge the Federal agencies, in cooperation with the Basin states, to define such policies and principles and to develop a long-term water quality management plan at the earliest practical date.

In this undertaking we believe that decisions will first have to be made as to which beneficial water uses are to be protected. The definition of water quality objectives for the Basin also must take into consideration the statutes governing the

affected state agencies and the policies of those agencies.

We pointed out in our presentation at the first session that California is vitally concerned with those activities which affect or pertain to the quality of the waters in the Colorado River Basin.

California users of these waters are located near the end of the ditch. Consequently, changes in these highly mineralized waters have a profound effect on approximately half of the seventeen million people residing in our state.

This particular aspect of the water quality problem is of concern to agricultural, municipal, recreational, and industrial users of the Colorado River water.

California has persistently urged that evaluations be made of the effects of upstream water uses upon downstream uses of the Colorado River water. It is our belief that appropriate agencies of the Federal and state level should undertake such evaluations on a cooperative and continuing basis with the objective of minimizing or eliminating potential hazards to the downstream users.

We also think that the results and findings of such evaluations should be reported promptly to the affected states in terms of effects upon downstream users.

That concludes our formal presentation, Mr. Chairman. But I would like to comment that the uranium processing industry and the Public Health Service, the other Federal agencies and affected states, are sure to be commended on the fine work that they have accomplished as relates to this particular problem.

We have a number of state agencies represented here today. Mr. Chairman, might I call on them to see if they have any comments?

MR. STEIN: May we ask if there are any comments or questions on your statement first.

You may go ahead.

MR. BONDERSON: Mr. Dallas Cole of the Colorado River Board of California is here. I wonder if he wants to make a statement?

STATEMENT OF
DALLAS E. COLE, CHIEF ENGINEER
COLORADO RIVER BOARD OF CALIFORNIA
LOS ANGELES, CALIFORNIA

MR. COLE: I don't think I have anything in particular to say. We concur in the statement made by Mr. Bonderson, who has been most cooperative concerning all of us in the state.

There are a few others here. Shall I introduce them?

MR. BONDERSON: Would you, please?

MR. COLE: Mr. Gilbert Lee, Supervising Hydrologic Engineer of the Colorado River Board staff. Mr. Don Maughan, Principal Hydraulic Engineer of the Colorado River Board staff.

MR. BONDERSON: Mr. Graham of the City of San Diego is here. I believe they are at the absolute end of the ditch here. Maybe he would like to comment?

MR. GRAHAM: No comment, thank you.

MR. BONDERSON: Mr. Dave Willets, of the California Department of Water Resources, is with us.

MR. WILLETS: I have no comment, unless it be to re-emphasize the request for the raw data which has already been expressed.

MR. BONDERSON: We have Mr. Swajian, who is Executive Officer of the Colorado River Basin Regional Water Pollution Control Board.

MR. SWAJIAN: I would like only to comment that I would like to invite Mr. Sponagle perhaps to look into the possibility of obtaining some assistance from the state agencies to develop some of this technical data which is costing quite a bit.

If there is some data that we can produce, since we are close, perhaps we could help out in this technical work.

MR. BONDERSON: Are there any other state agencies or individuals from California who would like to comment?

Mr. Chairman, I have one further observation along the lines of Mr. Swajian's comment. It appears that you are embarking on a most ambitious project.

Considering budgetary problems and the inter-disciplinary problems involved, it would, I think, be most essential that the project utilize all of the data and resources that are available in this undertaking that can be forthcoming from the Federal as well as the state people.

We would surely encourage this. I hope that California can give some aid and assistance in this area.

Maybe this is not the time, Mr. Chairman, but there is one point of clarification that I would like to have before this finishes as relates to Mr. Sponagle's presentation. This involves what is meant by the Basin.

In his presentation he makes reference to determination of salinity levels which will support optimum development in the Basin as measured by gross regional product.

As you know, there are out-of-Basin diversions. Does this Basin as used in Mr. Sponagle's presentation preclude an evaluation of the economic situation as relates to exportation?

MR. STEIN: Mr. Klashman?

MR. KLASHMAN: Mr. Bonderson, as Mr. Stein indicated when he was explaining our budgetary limitations, we have to take things on one at a time. We are well aware of the fact that here in California you have done a tremendous amount of work in what we call the service area -- that is, the area outside of the Colorado River Drainage Basin, but which is served by Colorado River water. You have done a tremendous amount of work in economics and in projections.

It is our intention, and we have already discussed this, to have our people who are working in this field get together with you folks and evaluate what you have done, and then we will determine what we have to do further in this field. If it is indicated that we have to do something further, we will consider that at that time.

I am sure we will be able to do whatever is necessary.

MR. STEIN: I don't know, Mr. Klashman, that that clarifies it. Maybe I need some clarification, too. But as I read Mr. Sponagle's statement -- and maybe we will call on him -- he says, "Investigations should be made, not only of pollution sources and concentrations, but more importantly, to determine feasible measures for protecting water quality for all uses so as to permit maximum economic growth and development in the Colorado River Basin."

Then he says: "Our plan of study involves four major steps: (1) Identification and characterization of major sources causing salinity increases."

He deals with salinity here, but when he gets under that he uses step (e), "water removed from the river system by trans-Basin diversions."

Do you care to comment on that, Mr. Sponagle, on Mr. Bonderson's question of what we mean by the Basin and what you mean in the sense by diversions outside the Basin?

MR. BONDERSON: Mr. Chairman, before Mr. Sponagle attempts to answer, maybe I should clarify the question just a little further in that he has listed the four points, and then he ends up that these four points provide a criterion of water quality associated with an objective of maximizing net economic benefits to the Basin.

Does "to the Basin" mean "in the Basin," or does this include the areas receiving exported water? That is what I am really asking, relating to this criterion.

MR. SPONAGLE: I think at the present time, in view of the limitations which have been pointed out here, that we are considering only the geographical area of the Basin. However, as we proceed in our work, we will have to consider also the economic benefits accruing to the areas outside of the Basin which also use Colorado River water. These exist not only in the Lower Basin, but also in the Upper Basin.

I think, to complete the picture, they will also have to be included in the total study which we undertake.

MR. BONDERSON: I gather he said they will evaluate this?

MR. STEIN: Yes. This is how I read his paper. The main thing is, I want this to be clarified. The answer is Yes. I hate to put this question this way. The point is that we will evaluate the economic benefits outside the Basin by trans-Basin diversions in this study.

MR. SPONAGLE: Yes.

MR. STEIN: I have a question to ask. Is there any doubt about your getting the raw data? I heard some comment here. As I understand it, raw data is available to all interested parties, isn't it?

MR. SPONAGLE: I think this was discussed at the last session of the Conference as well. We have been distributing the data obtained from our Radium Monitoring Network as it has been developed.

We provided the Conferees with the additional raw data that we had during the technical meeting at Santa Fe. We have not made widespread distribution to other parties of the raw data, but it will be available as indicated.

MR. STEIN: Thank you. There is one more point that you raised, Mr. Bonderson, which may need clarification. I don't think there is a difference of opinion on that.

You talk about water quality objectives or standards of pollution. I think you talk in terms of decisions to be made as to the beneficial water uses which are to be protected.

As I understand this problem, for anything as complex and as large as this Basin, the data studies and the economic studies in a sense are supposed to be directed toward that end.

The problem I think we have had, and some other people have had in coming to grips with this problem has been the absence of the economic studies and the data studies.

I would agree that by no means should we duplicate any work or do any work Federally where you have the data in a state or in one of your regional boards, or where they are better equipped to do the job and they want to do it. But, as I understand it, I do think the objectives of this data gathering and the economic study is to enable us to do this job.

May we have Mr. Caldwell of New Mexico.

STATEMENT OF
CHARLES G. CALDWELL, DIRECTOR
ENVIRONMENTAL SANITATION SERVICES
NEW MEXICO DEPARTMENT OF PUBLIC HEALTH
SANTA FE, NEW MEXICO

MR. CALDWELL: Mr. Chairman, Conferees, and Guests: We in New Mexico are very pleased with the progress that has been made on the Animas River in cleaning up water pollution control problems.

The Animas, as you know, is our greatest problem. The river which has been degraded over a period probably of several years has made good recovery. It speaks well for the Conference that so much has been done. Fishing is reported good and improving, and certainly the people in the area have every reason to rely upon the safety of their drinking water.

Speaking of the Colorado River project as a whole, there has been a tremendous amount of data evolved. Some of this data is already significant, and much of it will be even more significant in the years to come.

We in New Mexico are very much interested in the Animas and other water resources projects in the Basin and the impact that reduced river flows with an increasing population will have on New Mexico communities which take their drinking water from the river and then discharge their sewage plant effluents back into the river.

Certainly the bacteriological and chemical quality of the stream water will be adversely affected.

One solution for the problem would be for the affected communities to go directly to the Navjo Dam for their domestic drinking water. The alternative is to increase the efficiency of the sewage treatment plants by utilization of chlorination of the effluents, and also increasing the efficiency of the water treatment plants. Certainly chlorination should be adopted by all of the towns affected.

The communities affected include Aztec, Farmington, the San Juan River plant of the El Paso Natural Gas Company at Kirtland, the community of Shiprock, and the Bureau of Mines facility at Shiprock. These problems will be with us, and they must be resolved if we are to properly protect the health of the people of this area.

That is my formal paper, but I have one more point I would like to bring out. It was mentioned this morning that there was a question relative to the ultimate disposal of tailings waste.

I am wondering if anything is going to take place at Durango? As I understand it, the VCA mill there has closed down and they have taken over the mill at Shiprock, leaving this big pile of tailings up there. Does anybody know anything about that?

MR. STEIN: I don't know if anyone is here. Do you know anything, Dr. Tsivoglou?

DR. TSIVOGLOU: No, sir, I know of no plans. Perhaps Mr. Schoen does.

MR. NUSSBAUMER: The mills thus far that have closed down have not terminated their licenses, so their licenses are still in effect and the tailings are subject to control.

With respect to the control of the tailings after licenses are terminated, there are questions of the AEC's jurisdiction over these, and this is being looked at by the legal staff.

MR. STEIN: Let's see if I understand that. Who is responsible for the tailings now, Mr. Nussbaumer?

MR. NUSSBAUMER: While the mill is operating independently, the accumulation of tailings on the site, we feel, is under the jurisdiction of the AEC regulations.

MR. STEIN: That is right. But the mill that is taking over the Vanadium Corporation -- who is responsible for the tailings at Durango right now?

MR. NUSSBAUMER: The licensee, VCA.

MR. STEIN: Who is the licensee?

MR. NUSSBAUMER: Vanadium Corporation of America.

MR. STEIN: Even though they suspended operations and turned it over to another corporation?

MR. NUSSBAUMER: They still have a valid license to operate at that location, in spite of the fact they have shut down.

MR. STEIN: But the Vanadium Corporation is still the licensee and responsible for the tailings?

MR. NUSSBAUMER: That's right.

MR. STEIN: Let me get to the second point and see if I understand this. I understand that you may be contemplating terminating a license, leaving the tailings there without the notion that anyone will have jurisdiction over what to do with the tailings?

MR. NUSSBAUMER: We are not contemplating that. I am saying that the mill has not requested termination of their license. They are obligated to comply with Commission regulations.

At such time as they request that their license be terminated, then that introduces the question of what should be done with the accumulated tailings that exist at the site.

MR. STEIN: This suggestion, I think, has come to everyone in the room offhand. At least there doesn't seem to be a question of no one having jurisdiction as to the licenses terminated; but the point is, I don't know that the license necessarily has to be terminated until provision is made for adequate disposal of the tailings.

MR. NUSSBAUMER: That's correct. I mentioned that there is a question of jurisdiction over the tailings at the time the mill would request termination of their license. This is the problem we are working on.

MR. STEIN: Any further questions, Mr. Caldwell?

MR. CALDWELL: No. I would like to introduce Mr. Robert P. Lowe, who is Chief of our Water Supply and Water Control Division in the New Mexico Department of Public Health. Mr. Lowe.

Is there anybody else here from New Mexico? I don't think so. I haven't seen anyone.

Thank you.

MR. STEIN: Thank you. Mr. Gahr of Colorado.

STATEMENT OF
WILLIAM N. GAHR
CHIEF ENGINEER AND DIRECTOR
DIVISION OF ENGINEERING AND SANITATION
COLORADO DEPARTMENT OF PUBLIC HEALTH
DENVER, COLORADO

MR. GAHR: Mr. Chairman, I am glad to hear all of the Conferees express the belief and firm opinion that things are improving because we happen to be on the upper end of this water production business.

Formally, Colorado would like to say that the long-term Colorado desire always has been, and is still, to utilize all possible water resources -- for obvious reasons, of course.

In exercising this desire, the State has, as a State Government, created several State agencies. Probably the most important is the State Water Conservation Board, which was especially organized to promote good water utilization.

This Board, I would like to mention, frowns upon the use of water for diluting pollutants, when those pollutants can be economically removed by treatment. This is an indication of their thinking.

Our own Department, the State Department of Health, has a responsibility for most of the pollution abatement in the State. There is some division of authority. And, of course, as a Department, it encourages sewage treatment and it is prepared and does take enforcement action to bring about the discharge of effluents that are in compliance with standards.

Pollution abatement, of course, in this sense actually produces more water for higher uses. So it is an economic gain in that respect.

The control of water pollution in the Colorado portion of the Colorado River Basin, then, has continued to improve as we have observed it. The decline of the uranium industry has resulted in the closing of four of the eight mills.

I don't mean to imply that they were not working on proper waste disposal. They were, even prior to this shutdown of some of the mills. The waste disposal of those remaining is under control, and one of the largest operations is bringing about a control through the pumping of effluents to a lagoon. You will hear of that, I believe, later.

There is a refinery at Grand Junction which plans to spend around $70,000 on improving industrial waste recovery which will be pollution abatement. So, generally speaking, these operations in the mining industry and in other industries have led to an improvement in pollution control.

The treatment of domestic sewage is improving. An indication of this treatment is shown in a table which I will have to read to you. There are ten communities having a population of around 8,000 that have not yet gotten to do anything about treatment of their domestic sewage.

That is a small population when you consider that about 80-plus thousand people on the western slope have both primary and secondary treatment of sewage. So, comparatively, this 8,000 is a small number.

There are thirteen communities, constituting 18,430 people, that have primary treatment; and then a large majority of the communities, twenty-seven, constituting about 64,000 people, have secondary treatment.

In this second group that I mentioned, two communities are planning to replace primary treatment with enlarged and improved treatment. And two other communities in the first group are planning for new sewage collection and treatment systems.

So we see a picture here of a change from some sewage treatment, to even the better type of treatment. And I would like to point out that in Colorado we have asked for secondary treatment for a considerable length of time, in contrast with many of the places where treatment by primary means has been considered good sewage treatment.

So progress toward pollution abatement in Colorado has been started and is continuing. The greatest problem, of course, has been with domestic sewage, although industry has had its problems.

Fortunately, in both categories there is a willingness to invest the large sums of money needed to abate pollution. The standards of sewage treatment are higher in Colorado than in many states, as I mentioned.

It is necessary to use secondary sewage treatment to produce the effluent capable of complying with legal standards. An equally stringent regulation applies to industrial waste. Compliance with laws and regulations overall is good.

Pollution abatement activities involving Federal enforcement is of concern to some state authorities. This, I should explain, has stemmed from some interest on the eastern slope. It was generally believed that this project would not become involved in enforcement action.

So far this has been the case, and presumably I would expect it might continue in that vein unless circumstances require an alteration.

Whenever facts are developed indicating a pollution-caused violation, we think the State should have the right to make the decision as to what action will be taken. However, a cooperative State-Federal approach is often useful, should the State find help desirable.

This project does its best work in developing scientific information that can be used by enforcement arms of State governments, and of course, should this break down, then there is another logical step to go on; and no doubt the Federal Government has the right to step in at that time.

Water quality information produced by the Colorado River Basin study project is valuable to our State in planning future growth on the western slope. Our original interest was in securing scientific data relating to radioactive substances found mostly in surface waters, and this has been supplied.

Apparently there is to be a shift of emphasis toward evaluating the salinity problem in the Colorado River system. While this will be of less value to our State than the past scientific investigations have been, it will no doubt be of great value and of much interest to the Lower Basin States.

Finally, the direction to be taken by this project is important. The cost of operation approximates $500,000 a year. The Conferees should carefully weigh the merits of each new assignment suggested for study by the project. Obviously the project must come to an end, and plans for closing it out should be so timed as to make

certain that investigations for developing the most-needed information secure the top priority.

This aspect of planning probably should be considered even at this session, just as we have in the past attempted to give our suggestions for guiding the project toward obtaining that type of information we feel is most important in making a plan for a water resources use in the entire Colorado River system.

That, Mr. Chairman, is all I have to say.

MR. STEIN: Thank you. Are there any comments or questions?

MR. CALDWELL: I am wondering if the Public Health people have given any thought to when we are going to close this out?

MR. STEIN: Yes, I think so. I think this was outlined in the project. Do you want to speak to that, as to the phasing out of the project? How long does it expect to go?

MR. SPONAGLE: I believe that that project was initially set up and the time estimated was some five years for completion of its work. This project has been in existence for almost three years now. With expansion of our initial objectives in the radiological field, and with the transfer of our primary activity into the field of salinity, I think that it will take no less time certainly to conclude our work on this portion of the study.

The best estimate I could make at this time as to the completion of the work in this field would be some three or four years. The estimates that we have gotten for the completion of the economic studies that we are currently undertaking are three years. We should have our final reports completed shortly thereafter.

MR. STEIN: Does that answer your question?

MR. CALDWELL: That answers it.

MR. STEIN: Did you have any industries from your state, Mr. Gahr?

MR. GAHR: Mr. Chairman, I should like to ask those industries present to make themselves available now. I am sure that Mr. Bob Beverly, the Administrator of Radiation Controls for Union Carbide Nuclear Company, is here; and I believe that Mr. Beverly does have something to say in the way of a formal statement.

STATEMENT OF
ROBERT G. BEVERLY, ADMINISTRATOR
RADIATION CONTROLS
UNION CARBIDE NUCLEAR COMPANY
GRAND JUNCTION, COLORADO

MR. BEVERLY: Mr. Chairman, Conferees, and Guests: For the fourth year it is a pleasure to be in attendance at this conference. In response to Mr. William Gahr's invitation, I will make a brief statement concerning Union Carbide Nuclear Company's uranium milling activities in Western Colorado.

At present, we are operating three uranium mills on the Colorado River drainage system -- at Uravan, Rifle, and Maybell, Colorado. The end of this month completes four years of routine monitoring of mill effluents and river waters for radioactive constituents and certain dissolved chemicals.

With regard to our operations at Maybell on the Yampa River, and at Rifle on the Colorado River, the very small amount of liquid effluent which periodically reaches the river near Maybell, and the low radioactive concentrations combined with the large dilution of effluents at the Rifle mill, result in no significant effect from effluents at either mill.

The effluents at both mills are well below the concentration limits and quantity restrictions specified by the U. S. Atomic Energy Commission in our licenses.

At the Uravan mill we have continued radium decontamination of the main effluent stream (Plant-5 effluent). Although the river downstream apparently will never contain potable water because of the heavy salt uptake in the Paradox Valley, we are desirous of reducing certain chemical constituents released to the San Miguel River.

Last year at the Salt Lake City conference I discussed the research work and the numerous studies which had been carried out to find a suitable alternate means of disposal. Last summer a pilot-scale evaporation-seepage pond was operated with encouraging results.

Later in the year a seven-acre plant-scale pond was constructed on a portion of the only near-level ground in the vicinity of the Uravan mill. The pond was designed for maximum utilization of seepage through gravel beds and simultaneous natural decontamination.

An acid-proof, mile-long pipeline is presently under construction which, within the next thirty days, will be carrying the Plant-5 effluent to the large pond.

Although this single pond is not expected to dispose of all mill effluents for an indefinite period, its operation over the next several months will dictate the requirements for additional ponds. Space limitations in the narrow San Miguel canyon may be a critical factor, but it is hoped that a sufficient number of similar ponds can be constructed in order to permit continuous disposal of the main effluent stream in this manner.

This project has, of course, required considerable expenditures, and perhaps it will be of interest that it is the highest capital improvement item on our budget for the year.

We continue to keep the U. S. Atomic Energy Commission informed of all data pertaining to radioactivity and are following the work of the USPHS Colorado River

project with keen interest.

We noted, from radium monitoring network data released a few months ago, that the USPHS results corroborate our own results discussed last year, which showed a much higher soluble radium load carried by the rivers during the spring run-off months. This, in turn, continues to indicate the large portion of radium in the river system is originating from natural sources.

The guide, "Information Required and Criteria Used to Evaluate Embankment Retention Systems," issued for comment late in March, was thoroughly reviewed and detailed comments were submitted to the Commission in April. The guide represents a great deal of thought and considerable effort. We felt more distinction should be made in the guide between retention systems for liquid wastes and tailings ponds built solely for containing solids.

Again, we appreciate the opportunity to participate in this conference.

MR. STEIN: Thank you, Mr. Beverly. Any questions or comments?

MR. GAHR: At this time I should like to ask if Mr. Frank E. Brown of Climax Molybdenum Company happens to be in the room? Mr. Brown.

MR. BROWN: Yes, sir, but I have no statement to make except I would like to say we appreciate the problem and we appreciate being here. We think that we are operating successfully with regard to pollution, and we intend to remain that way.

MR. GAHR: Do we happen to have any representatives from other industries here? Apparently not.

Mr. Chairman, those are the only people who responded to our invitation, and they have been heard from.

MR. STEIN: Thank you, Mr. Gahr. Mr. Marx of Arizona.

STATEMENT OF
GEORGE W. MARX
DIRECTOR AND CHIEF ENGINEER, BUREAU OF ENVIRONMENTAL HEALTH
ARIZONA DEPARTMENT OF PUBLIC HEALTH
PHOENIX, ARIZONA

MR. MARX: Mr. Chairman, first I would like to compliment the Public Health Service and industry in the Upper Basin States for the excellent work they have performed in eliminating this hazard of radioactive materials in the Colorado River.

However, as Mr. Caldwell mentioned, I too am concerned about the ultimate disposal of the tailings. I have been concerned about this for some time, and I am doubly concerned now that I find that there is no definite responsibility set on this thing.

A mill can shut down and walk off and leave it. Who is going to be responsible for these tailings? If those things get away and get into the river, they can really create quite a public health problem.

That is about all I have to say at this time. We have some Arizonians here that I would like to introduce. If they have any statements, they may make them.

Mr. R. E. Polenske, engineer for the Arizona Water Company.

MR. POLENSKE: I have no statement, but I would like to reserve for next year at this time the opportunity to make a statement.

MR. MARX: We have Mr. Gookin, who is the water engineer for the Arizona Interstate Stream Commission.

MR. GOOKIN: Thank you. I have no statement. I appreciate the opportunity of being here. I am very much interested in the project which you are undertaking. I was particularly interested in the appeals for an early availability of the data which the project developed.

I would like to add my endorsement to that. This is certainly of vital interest to the Stream Commission. We would like to have these data as they become available, and we will be watching your project with great interest.

I hope we will have the opportunity of meeting with you later. Thank you.

MR. MARX: Is there anybody else here from Arizona?

I think those are the two who responded to our invitation.

MR. STEIN: Any questions or comments?

How do you feel about the Yuma situation? Do you feel you have an assured safe water supply now?

MR. MARX: I think that is in the negotiable stage between the City of Yuma and the Arizona Water Company.

MR. STEIN: There is one other question I think we might ask the AEC representatives for clarification on.

Is there any date, or tentative date, on which we may expect the criteria for the strengthening of these walls, the building of these lagoons for uranium mills?

MR. NUSSBAUMER: The comment period has ended and the comments are in. We expect to finalize the guide and have it distributed in sixty to ninety days.

MR. STEIN: Thank you.

Is there any other further comment or discussion? Does anyone in the audience want to make a comment now before we attempt to summarize? Or do you have anything to say?

STATEMENT OF
KENNETH E. TAME, METALLURGIST
BUREAU OF MINES
UNITED STATES DEPARTMENT OF THE INTERIOR
SALT LAKE CITY, UTAH

MR. TAME: Mr. Chairman, I am a representative of the Bureau of Mines in Salt Lake City, and I would like to say something.

MR. STEIN: What is your name?

MR. TAME: Kenneth Tame. I would like to make a short statement if it is all right.

MR. STEIN: Surely.

MR. TAME: The Bureau of Mines at Salt Lake City has been studying modification in conventional uranium ore processing methods which will permit disposal of radioactive wastes.

Specifically, such modifications consist of release of waste solutions within the mill, thus minimizing stream and ground water pollution.

I might add that a number of mills in the Colorado Plateau area have made these modifications and are re-using these waste solutions.

As we stated in our reports, the control of stream pollution by restricting the discard of waste solution meets the short-term requirements. However, percolation of surface waters through uranium mill tailings may slowly dissolve radionucleotides and in turn lead to ground water pollution.

In this connection, I refer to the presentation made last May by Mr. Struzeski of the Public Health Service, as reported on page 21 of the transcript. In paragraphs 4 and 5 he stated that, first, a geologist was added to the project staff in January of 1962; and since coming with the project, he has initiated studies as to the importance of ground water in the Basin.

Reconnaissance field trips have been made in areas of Colorado, New Mexico, and Utah, to obtain preliminary observations of the effects of ground water on the surface water of the river systems.

Second, preliminary evaluation of the waste disposal practices at the Durango, Colorado, Shiprock, New Mexico, and Mexican Hat, uranium mills as to the possible pollution of underlying ground waters by seepage of liquids from storage ponds has been undertaken. This particular study will continue and will additionally consider other uranium mills in the Basin.

We hope that the Public Health Service is following through on this research. We feel that, in using Dr. Tsivoglou's words of last year, we can allay this ghost of ground water pollution through such a study.

We made some small-scale percolation tests that indicate that that seepage through the ground does remove radium-226 quite effectively. We feel that if this study is completed, it will be a final solution to this problem and we won't be worrying about it any more.

Thank you.

SUMMARY
STATEMENT OF MR. STEIN

MR. STEIN: Thank you very much, sir. Are there any comments? Does anyone else want to make a comment or a statement?

If not, perhaps we can attempt to summarize briefly. I think there were two main aspects of the work taken up today, along with the radiation situation. One was the sediment and salinity situation. This is not to mean that the other tasks given the Conferees in the past will not be carried forward as priorities permit; and certainly the routine samplings of the sediments in Lake Mead will go on.

To take them in order, the first one was radiation. I think the radium levels of the Colorado River and its tributaries have been rather markedly reduced. In the words of Dr. Tsivoglou, our expert on this matter, the situation now is excellent.

I think there is no doubt that we are well within the limits allowed, and industry can say with pride that the health and welfare of the people are adequately protected from that source.

This has again been no mean accomplishment by a new industry and it demonstrates, it seems to me, what can be done by a cooperative industrial, state, and Federal effort.

The radium levels are considerably below the maximum permissible concentrations, or concentrations recommended in the Public Health Service standards for drinking water.

However, I think it was pointed out that, with some modification, the Radium Monitoring Network should be continued for the purpose of accident detection and the evaluating of average radioactive levels.

In connection with accident prevention, I think we are all awaiting with interest the promulgation of the guide and criteria from the AEC in dealing with retention walls for these waste disposal facilities at the uranium mills.

In addition, in conjunction with the Radium Monotiring Network, the analytical aspects as recommended should be extended to include monitoring other significant radioisotopes associated with uranium milling. This will include gross alpha activity, uranium, lead -210, and thorium.

In addition, in conjunction with perhaps the work on salinity, a thorough chemical analysis will be made at selected stations throughout the Basin because the resulting data will be very useful in aiding complete interpretation of the radioactive quality data.

All mill effluents are to be sampled for lead -210 and thorium once initially, with additional sampling at mills where it has proved desirable. Also, San Miguel River sediments in the immediate vicinity of Uravan will be sampled and monitored to evaluate thorium contamination.

There will also be water and sediment samples from Montezuma Creek at Monticello, Utah. There will be studies of residual contamination of farm lands and radium contamination of feed crops and milk.

There will be a study, and perhaps a proposal made, by a technical committee here dealing with the ultimate disposal of uranium mill tailings.

While this wasn't discussed, I would have the suggestion that, if this study is to be meaningful -- and if someone disagrees I would like to hear -- it should be done from its earliest planning stages in close cooperation with the Atomic Energy Commission. I think we have to develop joint proposals from the beginning if we are going to make headway in that area.

Now we turn to the salinity of the dissolved solid content of the Colorado River Basin waters. I think it is recognized that the increasing total dissolved solid content of the Colorado River Basin waters is a major problem of serious concern from a water pollution control point of view. It is desired that these water resources be protected against all types of pollutants which might affect the utilization of Basin waters.

Investigations ought to be made not only of pollution sources and concentrations, but also to determine feasibility measures for protecting water quality for all uses so as to permit maximum economic growth and development in the Colorado River Basin.

It is proposed to investigate technically feasible methods of reducing and limiting salinity and to evaluate the maximum net economic benefit which will accrue as improved salinity conditions are obtained.

I left out some words here. I said "which will accrue." I did not limit it to the Basin because I think all these obviously have to take into consideration that this is what is meant.

As I understand it, the plan of study includes four major steps: (a) the identification and characterization of major sources causing salinity increases. These include natural sources such as springs and ground water reservoirs discharging concentrated brines to the stream.

(b) Waste discharges from municipalities and industries.

(c) Returned irrigation waters contributing dissolved solids load.

(d) Consumptive uses.

(e) Water removed from the river system by trans-Basin divergence; and

(f) Water losses due to evaporations in reservoirs and canals and evapotranspiration.

The second element of the study is to evolve investigation of feasible measures by means of which salinity increases could be reduced.

Next, the study would be designed to project water quality conditions which would prevail with no salinity reduction measures in effect, against those which might be expected with institution of the various salinity reduction methods.

And, fourth, to determine the salinity levels at which net maximum economic benefits would accrue.

I think in connection with this it is anticipated to have -- as well as a technical study involving engineering, chemistry, radiology, hydrology and all the other sciences -- a major economic study to help us with this determination.

This, we hope, would lead to the material which would enable us to establish water quality criteria to be used in a water quality management plan for the Basin.

Are there any additions, modifications, comments, or statements on the summary?

MR. BONDERSON: Mr. Chairman, are you through summarizing?

MR. STEIN: Yes.

MR. BONDERSON: Why don't we take about a five-minute recess?

MR. STEIN: Certainly.

MR. DAVOREN: Mr. Chairman, having had experience with breaks and seeing the decline of the population immediately following, I thought I would make this announcement at this time.

Thanks to Stewart Mulford's thoughtfulness, he would like to offer a tour of the sea-water conversion plant in San Diego tomorrow to all comers at this conference.

As you may or may not know, this is one of the five major installations of this office, and a very successful one. In fact, it is so successful that it produces up to 1.4 million gallons per day which flows right into San Diego's municipal water system.

An interesting note I find is that the San Diego system actually puts calcium carbonate back into this clear water which they are getting from our wonderful plant.

You are all welcome to come tomorrow. How many are interested, in the first place?

(Show of hands)

Then we will just set it right now. Meet at 9:00 o'clock in front of the office here, and we will have cars there for you to get you to the plant.

MR. STEIN: Thank you very much, sir.

We will stand to recess for about five minutes.

(A short recess was taken.)

MR. STEIN: May we reconvene.

I think possibly we have a couple of pieces of unfinished business. One, I understand Mr. Caldwell would like some information on the procedure for alerting when there are breaks in mills.

Is that a fair statement?

MR. CALDWELL: That is a fair statement. May we hear from the AEC people?

MR. NUSSBAUMER: The procedure is that each uranium mill license has a condition, a requirement, that any failure in the embankment retention system that results in the release of radioactive material to an unrestricted area shall be immediately reported to the Region IV Division of the Compliance Office, which is in Denver.

The director of that Office will then immediately notify the appropriate state official. The appropriate state official is the one with which Region IV normally works in conducting its compliance inspections.

I am sorry but I don't have the names of the people involved who would be notified in each state. However, in carrying out the inspection activities, the Compliance Division has established contact with representatives, I believe largely in the state health departments. These are the people who would be notified.

In addition, the director of that office will also notify Mr. Sponagle, who is the Director of the Colorado Basin Project, who is also in contact.

MR. STEIN: Thank you.

We also have one other point which we would like to include in the summary, and this is a task for the project staff.

The project staff will develop for submission to the technical committee -- and hopefully for submission to the conferees at their next meeting -- the principles or policies which will be used by the project as a guide in the formulation of the comprehensive pollution control plan.

This is in recognition of the fact that the overall plan for comprehensive pollution control in the Basin is not related just to salinity and radioactivity. Obviously there are other aspects. Even as to salinity and radioactivity, I guess we have to have principles and policies.

This, I would expect, will be no easy job. But this will be attempted to be done by the project staff. Hopefully we will be able to come up with something at next year's session.

Are there any other questions or comments? If not, I would like to thank you all for coming. I hope the sun has burned those clouds away. I don't think we have lost too much of our audience.

We will stand adjourned until next year. I would suggest again, as we have in the past, that next year's conference will be convened on the call of the Chairman when we have decided on a suitable place.

Up to now we have been rotating the conference among the various states concerned. The conferees will decide where and when the next session will be held.

We would like to thank you again.

The conference is adjourned.

(Whereupon, at 4:05 p.m., the conference was adjourned sine die.)

GPO 874-363